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Report on the Geological Structure and Mineral Wealth of the Salt Range in the Punjaub; with Maps, Sections, &c.—By Andrew Fleming, *M. D., Edin. Assistant Surgeon, 4th Regt. Punjaub Cavalry. In charge of the Geological Survey of the Salt Range in the Punjaub. Season* 1851-52.

(Communicated by the Govt. of India.)

Preliminary Remarks.

In compliance with the instructions received at Maree on the Indus, on the 14th February 1851, from the Most Noble the Governor General, I have endeavoured to make such an examination of the Salt Range as will enable His Lordship in Council to judge as to the exact character of its mineral wealth.

The results of this examination have been embodied in the accompanying Report.

From unavoidable circumstances I was unable to commence the regular survey of the Range, until the end of February 1851, and owing to the heat was obliged to cease work in the middle of April.

On the 1st November 1851, the survey was again renewed, and the sanction of Government having been obtained for the construction of a Sketch map of the Salt Range (the want of which to guide us in our survey has been severely felt), Mr. William Purdon (1st Assistant), aided by Mr. William Theobald (2nd Assistant), was directed to devote his attention to its construction. The map herewith submitted is the result of their labours during the cold weather of 1851-52, to the end of which period the duration of the survey was limited.

The map is I believe the first which has ever been made of the Salt Range from a regular survey, and for its accuracy Mr. Purdon is alone responsible. I trust it will supply a want in all maps of the Punjaub hitherto published, in none of which, that I have seen, is even the general direction of the Range correctly laid down.

The geological examination of the Range has been executed entirely by myself, and in addition to that of the Salt Range proper, a rapid survey was made of its continuation in the range of hills which runs down the west bank of the Indus from Kalibag to Kaffin Kote. I thus have been able to add considerably to our previous knowledge of the geology of the Punjaub. A most interesting mass of hills called Kovana, which rise abruptly from the plain of the Jetch Doab, has also been examined.

During the course of my labours I executed a rough military survey, with a hand prismatic compass, of the district passed over, from which I constructed for my own guidance a rough sketch map. This I have had copied and coloured geologically, by a Mr. Blaney, an Eurasian draftsman, and herewith submit it as illustrative of my report.

The report itself will be found in many parts to be a repetition of the reports on the Salt Range I made to Goverment in 1848. These were drawn up after a very rapid inspection of the Range between Baghanwalla and Kalibag, in the month of April, a period of the year, when it is next to impossible to examine satisfactorily such hot and barren hills.

In the present report I have corrected several errors, the result of a too cursory examination of the strata, and have added very considerably to the matter of my previous reports.

I regret that I am unable to announce the occurence in the Salt Range of much mineral wealth, of the existence of which Government have not already been made aware.

The nature of the formations precludes the likelihood of any valuable metallic ores (we except those of iron) being found. The nature and character of the Coal deposits have been fully described; but, for reasons stated, we fear they will turn out of but little practical value.

In a scientific point of view, however, I would fain hope that much has been recorded which to Geologists will prove highly interesting.

As I was ordered to resume my medical duties at the close of my field work, it was necessary that the sections which accompany the report should be prepared before I separated from my assistants, who were directed to remain at Pind Dadun Khan.

These were hurriedly drawn in camp by Mr. Theobald from rough sketches made by myself in the field, and must be considered rather as sketches than true sections, which without the necessary data at the time as to heights and distances, it was impossible to have constructed.

The table of heights calculated from barometric and thermometric observations will, I trust, prove interesting as well as useful. I need hardly remark that they can only be considered as rough approximations.

A complete collection, for submission to Government, of the rocks, minerals, and fossils collected during my survey has been prepared, and, in compliance with Government orders, collections, illustrative of the mineral wealth of the Salt Range, have also been made for the museums of the Asiatic Societies of Bengal and Bombay and of the Agra College.

The preparation of my report and the examination and arrangement of my specimens have occupied entirely my leisure hours during the past hot season. I am aware that numerous imperfections are to be found in it, but in judging of its merits or demerits, I trust it may be borne in mind, that I have been in a position where books of reference or collections for comparison are quite inaccessible, and have consequently been entirely dependent on my own resources.

(Signed) A. Fleming, M. D.

Jhelum, Punjaub, Sept. 12th, 1852.

On the General Physical features of the Salt Range in the Punjaub.

The hills, generally included under the designation of the Punjaub Salt Range, occur in the northern part of the Sinde Saugor Doab, or distinct between the rivers Jhelum and Indus, crossing it from E. to W. between the parallels of 32° 22′ and 33° N. Latitude and 71° 30 and 73° 30′ E. Longitude.

The Salt Range may be considered as resulting from the union of three low independent ranges, subordinate to the Punchah branch of the Himalayas, which run towards the plain in a southerly direction.

The first or most easterly of these ranges runs along the left bank of the river Jhelum, and opposite the town on the line of the trunk road, receives the name of the Kharian Range. Further down the river this is known as the Pubbee Hills, and near Russool, famous for the position of the Seikh encampment after the battle of Chillianwalla, approaches the river, being evidently continuous with hills of similar character, which form its right bank between Darapoor and Jelalpoor, and which are locally designated Surafur.

The central or Rhotas range crosses the Peshawur road about 7 miles West of Jhelum, and stretches in a S. W. direction as far as the Boonah nullah. Here it takes a southerly turn, and under the name of Chumbah runs on to Jelalpoor, uniting in its course with the Kharian Range. The well known mountain Tillah, 18 miles S. W. of Jhelum, is the highest point of this range and not less than 3,000 feet above the level of the sea.

The western or Bukrala Range is separated from that of Rhotas by a ravine country about 10 miles in breadth. It runs parallel with the latter and after crossing the Boonah nullah at the Ghorigulla Pass, forms the ridge known as Diljubba, the west end of which unites with the general map of hills forming the Salt Range.

By the union of the Kharian and Rhotas or Chumbul ranges at Jelalpur, a ridge is formed presenting a steep escarpment to the south and a highly inclined slope to the north, at this point it is about three miles distant from the Jhelum, an alluvial plain intervening, the height of which does not probably much exceed 600 feet above the sea, and which, as we proceed westward, gradually expands into the plain of the Sinde Saugor Doab.

From Jelalpur the direction of the range is about west by south as far as Kuttba. Here it takes a turn to the S. W. running in this direction as far as Jubbi, which is its most southerly point. From this for a distance of about six miles, it runs nearly due west to Chooa, and then gradually trends round to the north, running from Futtipur to the Indus in a N. W. direction. It maintains the same course

for about four miles on the west bank of the Indus, beyond which it gradually expands into the mass of hills, that stretch north between Bunnoo and Kohat, and are known as the Chountuah Hills. The south-western portion of these along the west bank of the Indus, are elevated into a high ridge, presenting a steep escarpment to the east, evidently continuous with that of the Salt Range, and joining it near the village of Kooch four miles N. W. of Kalibag at nearly a right angle. This ridge known as the Chichalee Range runs in a direction S. S. W. towards the Koorum river, beyond which it may be said to be continuous with that of Kaffin Kote, forming the right bank of the Indus for several miles below the village of Bahadur Dok, and which is apparently a branch from the great Suliman Range, which runs parallel with the Indus in the Derajat and Scinde, and forms the natural western boundary of our Indian Empire.

In order to convey, if possible, an idea of the general features of the Salt Range, we shall follow its three natural divisions, into a southern or salt, a central or cultivated limestone, and a northern or sandstone district, beginning from Jelalpur where the Salt Range proper may for practical purposes be considered to commence.

Along its southern limits, the Range presents a most jagged angular outline, produced by a succession of points running towards the plain and separated by deep intervening strata. These points are covered and in many places formed of masses of rock and debris, which during the upheaval of the Salt Range, and subsequently from atmospheric and disturbing agencies, have been detached from a high escarpment with the strata of which they have undoubtedly been at one time continuous.

This escarpment extending from Jelalpur to the Indus is most prominently marked in the eastern part of the Range. Its continuity is frequently broken by deep transverse gorges, running parallel to the general line of dip of the rocks, through which the greater number of the streams which drain the Salt Range escape into the plains. None of these, except during heavy falls of rain, reach either the Jhelum or the Indus, but are absorbed by the thirsty sun-baked alluvial soil which instead of fertilizing, they convert into a comparative desert by the deposition of saline matter which they acquire in their course as they flow over the salt rocks which are chiefly confined to the southern district of the Range.

To this rule the streams which escape from the hills at Baghanwalla, Kuttha and Musakhail are exceptions. The two former though slightly saline are entirely consumed for agricultural purposes. The latter known as the Vehee River runs entirely through strata, superior to the Salt rocks and pours out a considerable volume of sweet water, a very small portion of which is employed for irrigation, the greater part being allowed to run to waste. By the judicious formation of an aqueduct (stone and lime are available in abundance on the spot) with sluices for the withdrawal of the water, means for the irrigation of a very considerable extent of now unproductive soil, could be rendered available. The various streams we have alluded to, after heavy rains, become suddenly swollen and, acquiring the characteristic impetuosity of mountain-torrents, bear along with them an immense quantity of boulders, gravel and mud, which are, along the foot of the hills, deposited in a succession of zones extending for two or three miles.

As may be supposed a district formed in this way presents a somewhat barren aspect, and with the exception of a scanty rain crop of Bajra* and Juar† and annual cotton, there is but little ground under cultivation. In the cold weather after heavy rain, it assumes a somewhat green aspect, but when rain does not fall, as was the case in the cold weather of 1851-52, hardly a blade of grass is to be seen, and much do the villagers suffer for want of water, they being in a great degree dependent for the supply of this necessary on seasonable falls of rain, which they collect in kutcha (mud) tanks, and which as long as a supply of water lasts are resorted to indiscriminately by men and cattle.

A stunted jungle of Capparis aphylla (kurul), Salvadora persica (pelu), Zizyphus (beir), Acacia modesta (phoolahi), and Prosopis specigera (jund), occurs along the foot of the hills, and affords grazing to numerous camels, sheep and goats, as well as an abundant supply of fuel to the villagers. These shrubs appear to thrive best in soil charged with saline matter, and form the mass of jungle in the uncultivated tracts of the Punjaub Doabs which generally present on their surface a white saline effervescence known under the name of kullur, and which is a mixture of salt and sulphate, with

* Panicum spicatum. † Holcus sorghum.

generally a trace of carbonate of soda. As we ascend the alluvial zones along the foot of the hills vegetation gradually diminishes, and on the Salt rocks, which are the lowest in the series, it seems to reach a minimum. A few stunted kurul, pelu and phoolahi bushes may be observed, but succulent salsolas* and other chenopodiacious plants known to the natives under the general term "java," with one or two interesting Cruciferæ characterize these, and abound in the Salt-marl. Above the Salt rocks vegetation again increases, but on account of the want of water along the foot of the escarpment of the Range, is every where scanty.

On reaching the summit of the escarpment which is formed of limestone rocks elevated into a ridge varying from 2 to 5,000 feet in height, we are introduced to a district of a totally different aspect from that to the south, presenting at first generally a considerable slope to the N., which is succeeded by a series of horizontal ridges with intervening valleys.

Between Jelalpur and Baghanwalla, the Range presents merely a ridge; but beyond the latter place this expands into a kind of table-land two or three miles in breadth, extending from the escarpment between Baghanwalla and Jutana N. to the foot of mount Drengan, the highest but one of the Salt Range hills which rises from it behind the village of Bisharut. This table-land is about 2,800 feet above the level of the sea, and, though entirely dependent on rain, is all under cultivation, and yields generally fair crops of wheat, barley, &c. It extends in a S. W. direction for about a couple of miles, and then becomes broken up by limestone ridges, into a succession of small cultivated valleys, one of which runs along the S. side of mount Kurringurli under the village of Vuhali.

Proceeding westward to Katass, we enter the district of Kuhun, which is made up of a succession of ridges and cultivated valleys about 2,000 feet above the sea-level. At the west end of this district is the Salt Lake of Kullur Kuhor (Kullur in Sanscrit means salt, Kuhor, Sansc. a lake). Its extent varies much in different seasons, but may be stated as about a mile long by half a mile broad, its

* These, in the plain along the foot of the Range, are, after the rains, cut, collected into heaps and burnt for the sake of their ashes, which are called saji muttí, a coarse kind of carbonate of soda.

greatest length being from east to west. It receives the drainage from the various hills around, and also a small stream of fresh water which enters it at its West end near the village of Kuhar. Its depth no where exceeds three or four feet, and its margin is formed of black fetid mud, outside which is a thick saline incrustation produced by the evaporation of its water. Its saline ingredients seem derived from salt springs, which issue from a mass of marl at its S. W. end. Its water is a strong brine, but owing to the constant drainage into it, after rains, of fresh water, it never reaches a point of concentration sufficient to admit of salt being deposited in the bottom of the lakes. After any heavy rains and when its surface-level is considerably raised, a portion of its water finds an exit by a nullah at its N. W. corner, which joins a small stream called Nunva in the hills to the north. This periodical overflow also assists in preventing the concentration of the water. It appears to contain no fish, but it is a favourite resort of ducks and other water-fowls.

Beyond Kuhar on to Pyle, the district becomes more hilly and only occasional patches of cultivation are to be seen. Here the Range, which to the eastward does not exceed ten or twelve miles in breadth, becomes narrow ; but soon rapidly expands into a mass of hills which at their broadest point, North of Jubbee, is probably not less than eighteen miles.

Among these are several cultivated valleys, the principal of which are those of Khubakkie and Lone Lihesur. The former presents nothing remarkable, except that after heavy rain, one or two small lakes form in its lower parts.

The Lone Lihesur valley is about twelve miles long, and three broad and is inland, between two ridges of limestone hills. It is for the most part under rich cultivation, and in the hot weather has the reputation of being as cool as Cashmere. At its west end is a great salt lake called " Sumundur," three miles long by one and a half broad, and beyond it mount Lihesur, the highest point of the Salt Range, attains an elevation of about 5000 feet above the sea level. Here the central district of the Range may be said to end, its summit forming a ridge on to the Indus.

The Salt Lake or Sumundur (sea) is in every way similar to the one of Kullur Kuhar, but as far as we are aware, receives no perma-

nent streams. During rain, the drainage into it from the Gumundra, Putial and Kurrung ridges, which surround it, must be very considerable, and the boulders in several nullahs which enter its eastern extremity, mark the force of the floods which it at times receives. There appears no exit for the waters of the lake, which by solar evaporation must be kept within due bounds. All the hills by which it is surrounded are composed of limestone, and hence it is probable that salt springs enter it from below. Its water is a strong brine, and a thick saline incrustation covers its banks.

South of the salt lake, in the hills between Kufree and Vurcha, and about four miles from the former, is a fresh-water lake of considerable depth called Julhur Kuhar (Julhur, Sanscrit, a spring of fresh water), about three quarters of a mile long by about half-a-mile broad. It is most picturesquely situated at the foot of a limestone escarpment, and receives the drainage of the limestone hills around and of the small valley at the west end of which it is placed. We believe we were the first Europeans who had ever visited it, and were not aware of its existence till we stumbled upon it accidentally. The pleasure of beholding such a sheet of fresh water cannot be appreciated to its full extent but in the midst of hills like the Salt Range, where fresh water is no where abundant, and clean water is a scarce luxury.

The vegetation in the central and northern districts of the Range presents a striking difference to that on its south side, but though the hills attain to a considerable height, there is nothing to indicate an approach to an Alpine flora. The want of any of the ordinary trees characteristic of the Sub-Himalayan ranges of elevations from two to five thousand feet is very remarkable, and with the exception of a few stunted Hyperanthera and semul trees (Bombax heptaphyllum), whose large scarlet flowers appear in the months of February and March, nothing deserving the name of a tree is to be seen on the Salt Range from the Jhelum to the Indus. This we conceive is to be attributed entirely to the general absence of soil on the surface of the limestone rock of the district, the debris of which seems all to be washed into the valleys, where it forms a productive soil. But although trees are deficient, the hills of the central district present a green and refreshing aspect, being generally covered

with a low bush jungle, formed in great part of Dodonæa Burmanniana (Sunhetta) and Adhatoda vassica (Behikkur). These two shrubs, but particularly the former, may be considered as peculiarly characteristic of the central district, their fibrous roots penetrating deeply into the soil between the rents and fissures which every where traverse the limestone strata. Mixed with these may be observed the Phulahee and the Kow—a species of Olea* famous for its long and straight sticks which make excellent hammer or hatchet handles.

After rain a good deal of grass springs up, forming tufts along the fissures in the limestone; and a by no means inconsiderable number of the smaller flowering plants may also be collected during the months of March, April and May.

The northern district of the Range is formed of a succession of ridges of soft sandstones and clays separated by deep ravines. These present an escarpment to the south and dip to the north at a high angle under the plain of Potowar, the general name for the country north of the Salt Range, and which in its neighbourhood does not probably exceed 1,000 feet above the level of the sea. They are of small breadth in its eastern and central part, but towards the Indus expand into barren hills that extend from Marie to Mokhudd; a distance of fully 16 miles.

This district presents scarcely any cultivation, and its natural vegetation is much the same as that of the central district, though less abundant. The Grislea tomentosa (Tawa) is the only shrub we have observed to be confined to the soft sandstone ridges.

In the Salt Range all goods, &c. must be conveyed on camels, mules, or bullocks; paths passable for loaded camels cross it at Dundhote, Mukrach, Lurdi, Nurpur, Kuttha and Nummul. The best of these are the Dundhote, Kuttha and Nummul ones. The traffic over them is, however, small, and chiefly confined to salt. The grain grown in the Salt Range is, we believe, not more than sufficient to supply the wants of its population, which is chiefly Mahomedan.

* Probably O. europæa.

On the Geological Structure of the Salt Range in the Punjaub.

All the rocks forming the Salt Range appear to belong to the strata termed fossiliferous by Sir Charles Lyell, whose classification will be followed throughout the present Report.

We recognize then the following formations in an ascending order, and under each of these shall endeavour shortly to describe their various characteristic subdivisions, noticing as we proceed the minerals, &c. which they yield.

1	Primary or Palæozoic.	Devonian.	*a.* Red marl with gypsum and rock salt. *b.* Lower red sandstone and grit, with conglomerate. *c.* Greenish micaceous sandstones and shales with grey dolomitic (magnesian) sandstone. *d.* Upper red variegated sandstones, grits, conglomerates and clays.
		Carboniferous.	*a.* Lower limestone, calcareous sandstone and shales. *b.* Grey sandstone and shales. *c.* Upper limestone, sometimes magnesian.
2	Secondary.	Oolitic.	*a.* Yellow iron-stained quartzose sandstones, grits and bituminous shales. *b.* Cherty thin bedded limestones with shales. *c.* Green Belemnite sandstone and shales.
3	Tertiary.	Miocene? Eocene.	Brown calcareous sandstone, nummulite limestone, marls and alum shales with lignite.
			Greenish sandstones argillaceous grits, conglomerates and red and green clays.
4	Post Tertiary.	Recent.	Alluvium.

Primary, fossiliferous Devonian Rocks.

a. Red marl with gypsum and rock salt. This rock gives to the Salt Range one of its most characteristic features, appearing generally at the foot of its southern escarpment, and in the bottoms of the various deep ravines which intersect the hills.

The marl occurs as the lowest rock, being subordinate to a red sandstone into which it seems to pass, the transition being marked by dark coloured fissile argillaceous beds. At Jutana and in the Chukie Wan near Jubbee, a coarse red sandstone with bands of conglomerate is seen in some places, cropping out under the marl, but as great disturbance occurs among the strata at these localities, and as the sandstone is identical in mineral character with that which in the regular order of things appears above the marl, we are disposed to consider its occurreuce under it in the localities above mentioned as the result of an overturn.

The marl can be recognized at a distance by its most singular brick red colour, totally different from that of any ordinary clay, which immediately impresses one with the idea, that it has been subjected to igneous agency.

It does not disintegrate when treated with hydrochloric acid, but iu powder effervesces strongly, the greater part remaining undissolved, in the shape of a red mud composed of clay and sulphate of lime or gypsum. The portion soluble in acid, cousists of carbonate of lime and carbonate of magnesia in about equal proportions with a little alumina and peroxide of iron, to which latter substauce the marl owes its colour. The rock is therefore a clay, cemented by gypsum and the carbonate of lime and magnesia into the consistency of stone, the gypsum predominating aud frequeutly appearing in laminæ of selenite in the marl, which sometimes presents a radiated aspect, from a peculiar crystallization of the sulphate of lime.

In many places it is traversed by veius of gypsum, which seem to have been formed in rents in the marl, and give it a most singular honey-combed appearance. These veins often traverse the included irregular beds of gypsum, proving they are more recent than those, though in mineral character the gypsum of both the veins and beds is identical. In several localities thin beds of chert and coarse silicious sinter, containing patches of chalcedony may be observed.

The marl is extremely tough, and ou this account, though by no means hard, the work of sinking shafts or galleries in it, is very laborious. It forms hills, some of which rise to the height of 1,500 feet above the sea, of a most jagged appearance, which is in a great measure produced by the heavy falls of rain, dissolving out the

gypsum, and its earthy carbonates, and forming in it deep ravines and channels. These by undermining the marl frequently produce extensive slips, which cause serious annoyance in the working of the salt.

On tracing up some of the ravines, where the marl is well developed, it seems to form the centre of an anticlinal axis, the rocks superior to it (see Table No. 7) dipping away from either side of its out crop at a considerable angle. At the end of some of the gorges, it often presents an amphitheatre of small hills surrounded by scarped precipices of the superior rocks. This may be well seen at the upper part of the Milawan ravine below Nurpur and in the Seral Ravine at Surdee, in both of which localities it has a remarkably eruptive aspect.

In the eastern part of the Range, the marl presents scarcely any traces of stratification. Towards the Indus, however, in the neighbourhood of Chooa, Vurcha and Futtypur, where it is extensively developed, thin beds of argillaceous dark red sandstone occur in the marl, and indicate its being a stratified deposit.

At several places, but particularly around Pind Dádun Khan, the marl for some depth from the surface has much the character of a breccia; angular masses of salt gypsum, sandstone and limestone similar to those occurring in situ, being diffused through it. As the numbers of the fragments appear to decrease the further from the surface we examine the breccia, and as they are most numerous where there is evidence of the greatest disturbance in the surrounding rocks, it is most probable that the breccia marl, which we have seen in some ravines fully 200 feet thick, has been formed on the surface of the regular marl at the time of, or subsequent to, the upheaval of the Range to be hereafter noticed. Indeed its formation may be observed after every heavy fall of rain, which washes large quantities of red mud and fragments of rock into hollows in the marl, which ultimately become cemented by the infiltration of sulphate and bi-carbonate of lime, held in solution by the rain-water, and derived from the strata over which it passes in its downward course.

We have hinted that the marl in some places has a singularly eruptive appearance, but the distinct proofs of stratification which it

presents in the western part of the Range negatives the idea. It is probable however, that it has undergone metamorphism from igneous influence, the exact nature of which it is difficult to ascertain. In no one locality in the Salt Range is there any evidence of the existence of plutonic or volcanic rocks by which this metamorphism could be effected, or the great disturbance produced, which is apparent every where. In addition to the brick red colour of the marl, which at once associates itself with the aspect of a well-burnt brick-kiln, the contained gypsum in many places and particularly on its surface, is converted into a powder-like plaster of Paris, which can only be prepared artificially by baking gypsum. This appearance is most common towards the upper parts of the marl, on which at Kewrah, Mukrach and Nurpur patches of a most singular chocolate-coloured argillaceous rock of a somewhat trappian aspect occur, just at the point where the marl passes by fissile argillaceous beds into the red sandstone. It every where appears broken up into small masses, which sometimes present a scoriaceous aspect, and include a curious radiated mineral not unlike some varieties of Tremolite, nodules of green clay, and nests of talc. The patches of this rock are quite superficial, and do not extend beyond twenty or thirty feet, except in the gorge above the Kemah village, where it seems to form a bed about $1\frac{1}{2}$ feet thick, which may be traced on the West side of the gorge for about 80 yards, when it thins out, passing apparently into argillaceous sandstone, a metamorphosed portion of which it appears to be.

It effervesces slightly with muriatic acid, which dissolves a little peroxide of iron, alumina and carbonate of lime with a trace of magnesia.

In addition to the above indications of the marl having been subjected to a high temperature, we would add the fact that the fissile sandstones resting on the marl are every where rent and shivered into small fragments, which appearance gradually vanishes as we leave the marl. The beds of chert and sinter before noticed as occurring in it, could only have been deposited by thermal waters, silica being only soluble in water (generally alkaline) at a high temperature and under high pressure.

Minerals.

The only two minerals of importance which the red marl yields are rock salt and gypsum. These we shall notice in detail.

Rock Salt.

This valuable mineral, the origin of which is so veiled in obscurity, occurs in the marl apparently in a bed from 150 to 200 feet thick, towards its upper surface, but wherever salt occurs, masses of it of all sizes, which have been detached from the original bed, are found scattered through the marl at various depths.

Three varieties of salt occur, the red, the white and the transparent or glass salt. The former is obtained in greatest quantity, and being tougher and more difficult to reduce to powder than the other two varieties, stands transportation better, and is consequently in greatest demand among the salt merchants.

The mineral in all its varieties is a nearly pure chloride of sodium, the only foreign soluble ingredient it contains being a trace of sulphate of lime. Except when the salt is mixed with marl, it contains no chloride of magnesium, an impurity which generally occurs in rock salt, and the absence of which in that of the Salt Range renders it but slightly deliquescent. The colour of the red salt is not, as might be supposed, derived from a salt of iron or manganese, but is probably of an organic nature.

The salt has every appearance of having been formed by crystallization from a brine solution, in which much marl as mud has at times been mechanically suspended. At the lower and upper limits of the bed, where the deposition of the salt has commenced and ended, it is much mixed with marl, but in its interior this merely forms thin partings in the pure salt, which mark its stratification. As the salt presents more of a crystalline aspect in the interior of the bed, than at either its upper or under surface, we are inclined to think that it has been there formed during a very slow evaporation of the brine solution, which from the absence of mud, must have been in a state of great quiesence. The salt is every where solid, and never presents cavities lined with crystals of salt, which we would expect to find had it been a sublimed product.

The salt bed bears evidence of having been exposed to violent disturbing agency, as it can never be traced for any distance in the

interior of the veins, without observing frequent fractures in it, or partial faults, which are generally filled with coarsely powdered salt, gypsum and marl, produced probably by the fractured ends of the bed rubbing against each other during the process of upheaval, or from subterranean movements subsequent to this.

The mineral has hitherto been mined in a most primitive manner, no alterations or improvements having been introduced, since the annexation of the Punjaub in 1849.

When a spot has been fixed upon, as a promising locality, a tunnel is cut in the marl about five feet high and three and half feet broad, and carried on until salt is reached, the proximity of which is generally indicated, by the marl becoming moist and assuming more the character of a dark red clay. The mineral is then excavated as long as a supply is procurable, no attention being paid to leaving pillars at intervals for the support of the workings, the consequence of which is, that great annoyance is experienced from the falling in of the roof of the mines; and accidents to the unfortunate miners themselves are of frequent occurrence. Should the shaft have been sunk on, and reached only a mass of salt, after this is worked out, the mine is either abandoned, or a gallery driven to a greater depth into the marl until another large mass is found or the salt bed reached. As this invariably has a strike and dip corresponding to the strata superior to the marl, the stratification of the salt guides the miners in their onward course. Along the bed, the process of working is the same as on the masses, the whole of the good salt being mined without leaving any support for the roof of the workings, there being nothing more than huge caves excavated entirely in the salt, which is seldom or ever worked through, either in the floor or roof of the caves, because as the salt approaches its matrix it becomes intimately mixed with marl, and is highly deliquescent from containing magnesia.

In almost every mine in the Salt Range the evil of having left no pillars for the support of thin roofs, &c. is experienced, and some of the larger and best mines have been in a great degree abandoned, in consequence of their becoming filled up with huge masses of salt, gypsum and marl. As the marl is the lowest rock in the Range, and dips under all the others in a northerly direction at an angle of from

25° to 40°; as might be expected, much trouble is occasioned by the filling of the mines with water when they reach to any great depth. During the rains too, in July, August and September, the water rushes through passages in the marl into the mines, and by detaching large portions of rock render them quite unsafe. In these months, the miners desert the mines; partly on account of their danger, and partly on account of the intense heat and numerous fleas and musquitoes which infest them and their neighbourhood.

In consequence of the irregular way of carrying on the workings, the passages into the various mines exhibit at present a succession of ascents and descents over a series of rude steps, which sometimes become so polished and slippery as to render walking over them a matter of some difficulty.

In extracting the salt, the chief instrument used is a hammer, pick-shaped and hard-tempered at one end, and with a round head at the other. A mass of salt being fixed upon as the scene of operation, a portion is lined off, about two feet thick, and along this a groove is cut with the sharp pointed hammer to the depth of some eight or ten inches. Larger sharp pointed hammers as wedges are then introduced at intervals along this line and on their broad heads a series of sharp blows are inflicted. This generally detaches a block of salt, which is then broken up into lumps of a size convenient for being carried out of the mines. The amount of waste resulting from the above method of working is something immense, and as powdered salt is not saleable as long as lumps can be had, it is generally shovelled into the bottom of the workings where frequently there is a deep brine pool ready to receive it.

Instead of making a deep groove along the limits of the mass, it is desired to detach, (we believe the object could be equally well attained by adopting the plan used in the granite quarries of Scotland, and which is as simple as it is effective.) Small holes three or four inches long, two inches broad and four inches deep are picked out at intervals of eight or ten inches in the mass which it is desired to split. Into these holes truncated iron wedges are introduced. Each of these are in succession driven into the holes and continue to receive sharp blows till the mass splits, which is at once known by the elasticity of the stone causing the wedges to jump out of their

holes. A lever is then inserted into the crack and the divided portions separated. Were this process introduced in the mining of the salt, we are satisfied that a considerable saving to Government would be effected. On account of the dangerous state of the roofs of nearly all the mines, gunpowder is seldom used, and hence all the work is done by the pick and hammer.

The mines are generally very faintly lighted by small oil lamps made generally out of bits of salt, the glimmer from which reflected from the sparkling salt and salt-encrusted bodies of the workmen has a most singular effect. From the want of circulation of air in most of the mines and the dampness of the atmosphere, the heat is most oppressive, and from the filthy habits of the miners, the stench in some of the mines is quite overpowering. In the month of December when the temperature of the external air was 71° in the Buggie Mine at Keurah, the thermometer indicated a temperature of 81°.

Men, women and children indiscriminately pursue the avocation of salt miners. Families generally work together, the mother and children being chiefly occupied in carrying on their backs the masses of salt from the workings to the mouth of the mine, which the father has quarried. Like miners generally, they are a somewhat discontented set, and strifes among them are by no means uncommon.

The pay of the miners varies a good deal. At Keurah, Mukrach and Vurcha, salt is turned out at the mouth of the mines at the rate of Rs. 3-12 per 100 maunds (£0 7*s.* 6*d.* for 8,000 lbs.) at Surdee they receive Rs. 2-8 (£0 5*s.* 0*d.*) while at Kalibay where the salt occurs in enormous masses which crop out on the surface of the marl, and which have only to be broken up and removed, they receive Rs. 2-14 for quarrying it, and Rs. 1-5 per 100 maunds for conveying it to the depôt at Marree. The above rates include the expense of oil, instruments, &c., all of which are supplied by the miners themselves.

The quantity of salt that can be turned out in a day by a good workman is about 10 maunds (800 lbs.) which at the present rate of Rs. 2-8 per 100 maunds would give the miner 4 As. or 6 pence. Where, however, a family work together, the father and perhaps one of the sons mining while the mother and children remove the salt, their earnings amount to something considerable.

The general appearance of the miners varies greatly. At the end of the hot season they appear very sickly and sallow, but towards the close of the cold weather they do not appear to us to have a more unhealthy aspect than the inhabitants of towns in the Punjaub generally have.

They however suffer a good deal from sickness; but this is probably more owing to the position in which their villages are placed, and to their filthy habits than to their trade. Certain diseases such as ophthalmia and pulmonary complaints are very prevalent among them, and doubtless result from the injurious effect of the finely powdered salt acting as an irritant on the mucous membranes. Fever is very prevalent among the miners at Keurah, where, perhaps from the confined position of their village, they look far more sickly than at most of the other mines.

Goitre is a frequent complaint, but particularly so at Kalibagh, where every one seems more or less affected by the disease. This the natives ascribe to the Indus water which is generally of a milky colour from fine calcareous mud mechanically suspended in it, and which the addition of a little alum speedily removes.

Dracunculus or guinea-worm is also very prevalent, but is by no means peculiar to the Salt Range, being a common complaint all through the Punjaub among the natives, whenever they are dependent on tanks for their supply of water.

As a general rule it may be observed, that where the supply of water to a village is obtained from a kutcha (mud) tank, out of which men and cattle drink indiscriminately, a circumstance, from necessity, by no means uncommon, there guinea-worm will prevail, while in villages supplied by running streams, the disease will be unknown.

During the Seikh rule, salt was mined at almost every spot where it cropped out, but to prevent smuggling most of the mines have been shut up since the annexation of the Punjaub, salt being now only extracted at Keurah, Mukrach, Surdee, Chooa, Vurcha and Kalibagh. At all these places there are regular salt depôts, and there only can merchants procure a supply at the rate of Rs. 2 per maund (£0 4*s.* 0*d.* for 80 lbs.) For whatever quantity they may purchase they receive a permit, and should an ounce more than this indicates,

be found in their custody, confiscation of the salt, and of the mules, bullocks or camels on which it is loaded, is the punishment awarded.

To prevent smuggling wherever salt occurs in the marl or is supposed to, from the occurrence of strong brine springs, a guard is posted, and the villagers are not allowed to take away even for their cattle the saline efflorescence on the sides of the numerous brine streams, which issue from the range or even a pitcherful of the brine itself. As only the very poorest class of natives would think of using the dirty salt on the sides of the streams, or of evaporating the brine in order to obtain a small supply, this proscription falls very hard upon them, and they cannot understand why they may not as well avail themselves of the kullur or kourah pani as allow it to be wasted.

Of all the mines in the Salt Range those at Keurah near Pind Dadun Khan, yield the largest amount of salt, and those of Chooa, Vurcha the least. The annexed table, the materials for the construction of which we are indebted to W. Wright, Esq., Collector of Salt Customs in Punjaub, shows the quantity of salt extracted from the mines at each of the different salt stations or depôts during the commercial years, 1850 and 1851, with the amount of revenue realized by its sale.

	1850.			1851.		
	Maunds.	Seers.	Chittacks.	Maunds.	Seers.	Chittacks.
Keurah mines,	4,63,440	14	2½	3,84,242	19	11
Mukrach ditto,	1,46,525	5	0	1,31,773	23	6
Surdee ditto,	42,505	20	0	19,628	31	4
Chooa, Vurcha ditto,	36 385	2	8	39,699	26	0
Kalibagh,	79,747	23	2	65,274	7	6
Grand Total,	7,68,603	24	12½	6,40,618	27	11
	Rs.	A.	P.	Rs.	A.	A.
Revenue yielded at the rate of Co.'s Rs. 2 per maund of 40 seers,	15,37,400	1	7	12,81,295	14	10

The introduction of a scientific system of mining a mineral which yields so large an amount of revenue to Government is of such vast importance that we cannot close our remarks on the salt deposit, without urging the necessity of securing the services of a practical miner, who from extensive experience acquired under-ground in some of the large salt mines of England or the Continent, is thoroughly capable of introducing and carrying out the improvements required. Under his guidance, the mineral should be extracted, shafts sunk, and the whole interior economy of the mines regulated.

The operations now in progress with a view to run a tunnel into the Sugaswalla mine at Keurah, which from the efforts of the former primitive way of working it, is almost entirely blocked up, are, we trust, only the commencement of a series of reforms, which if carried out with vigour by duly qualified superintendents, are certain to be followed by the best results. It will probably, however, be found more economical and satisfactory to sink entirely new mines through the marl into the salt bed, than to attempt radical changes in mines that have been long worked, and had their roofs extensively undermined by the indiscriminate excavation of salt. The waste in working the salt is now so great, that we are convinced with a little care and the introduction of an improved system of mining a large amount might annually be saved to Government. It is not enough to say that because the supply of salt is so abundant, there is no necessity for changing the method of mining that has been adopted from time immemorial.* The supply of salt is undoubtedly large, but as there is such a deal of difficulty, nay impossibility, in the present workings of obtaining accurate information as to its extent or thickness, we conceive it is the duty and interest of an enlighten-

* We have been quite unable to obtain any accurate information as to the period when the salt mines were first opened. The natives assert it was during the reign of the Emperor Akbar (whose accession dates from 1556) to whom the existence of salt in the Salt Range was disclosed by one Asp Khan, on condition of his receiving, as a reward, during his life time, a sum equal to the amount of the wages of the miners employed in extracting it. During Akbar's reign, it is a matter of history, that Lahore salt sold at the rate of about six annas a maund. In the Kohat district at the present time it may be brought for use Trans-Indus at four annas a maund !

ed Government to economize the mineral as much as possible. The powdered and inferior salt now wasted in the mines, might all be saved by dissolving it in water in deep tanks. In these all mud and mechanical impurities would rapidly subside, and on the brine solution becoming clear, it might be run off and evaporated by the heat of the sun in other shallow tanks or by passing the brine through mattings exposed to the sun and air, on which it would rapidly crystallize. In the Austrian mines, the brine obtained from impure salt is dried up in large evaporating houses, but as in this country the heat of the sun would serve instead of fuel, the expense would be but trifling and a large quantity obtained of a salt which for many purposes would be preferable to rock salt.

By economizing also the numerous brine springs and streams which issue from the Salt Range a large supply of an inferior salt could be obtained, and which if sold at a cheap rate, would, we believe, be extensively purchased by the natives, for agricultural purposes.

A large quantity also of an impure salt (a mixture of chloride of sodium and sulphate of soda) might be collected from the banks of the Kullur Kuhar and Sumoondur salt lakes,* which is now utterly useless, the natives on their banks not being even allowed to remove it to give their cattle.

Gypsum.

Gypsum occurs in the marl in a manner similar to the salt, irregular beds and huge masses being scattered through it, wherever it occurs in beds it is much cracked, the fissures being filled with red marl or a bluish clay. Beds of it seem to be both above and below the salt. In some localities the strata of gypsum are remarkably bent and contorted, as if they had been subjected to violent, lateral pressure, previous to their being shattered and upheaved. The mineral is for the most part of a light grey colour with a shade of blue, and translucent on the edges. It has a saccharine appearance, but masses in which a coarse crystalline structure prevails are by no

* The water of this lake has a Sp. Gr. of 1.02 five hundred (500) grains evaporated to dryness yielded 14.97 grains of saline matter consisting of sulphate of soda and chlorides of sodium and magnesium with a trace of chloride of calcium.

means uncommon. Red varieties also occur and beds of a dark grey earthy gypsum are generally associated with the saccharine kind.

It is a nearly pure sulphate of lime and appears to be free of any admixture of carbonate of lime.

When calcined it yields a pure plaster of Paris, which sets rapidly when mixed with water. Gypsums, however, in which carbonate of lime is absent, form, when calcined, a less coherent cement than those where it occurs to the extent of 10 or 12 per cent. By a due admixture therefore of quick lime with the calcined Salt Range gypsum, its hardness as a cement or mortar will probably be increased.

The natives do not appear to be aware of the properties of gypsum when calcined, though they use it in fine powder mixed up with pure lime into a mortar, to produce the shining marbly appearance, so often noticed in their finer chunam work.

In the department of public works, the use of gypsum might be successfully introduced for various building purposes, and a supply to any extent might be procured from around Pind Dadun Khan.

In the gypsum of Maree and Kalibagh and also at Surdee, very perfect rock crystals occur generally in the form of six-sided prisms terminated by six sided pyramids. After rain these spangle in a most striking manner, and hence have acquired the name of Maree diamonds. Transparent, red and milky varieties occur, the former being the most abundant. The longer and more perfect crystals are much esteemed by the natives, who manufacture them into necklaces.

Very perfect crystals of iron pyrites also occur in gypsum in the Keila Wan above the village of Khond, from beds, of which a sulphur spring issues at a natural temperature, depositing sulphur on the gypsum over which it flows.

In proceeding along the Salt Range from E. to W., the first indications of salt marl occur in the S. E. or scarped side of mount Tillah, where it is very indistinct, being in great part concealed by Tertiary sands and clays. From the West end of mount Tillah it may be traced along the foot of the scarped or West side of the Chumbul ridge to Jelalpore where it is considerably developed, but in the midst of such great disturbance that its relative position can with difficulty be made out. To the West of Jelalpore there is no distinct outcrop of the marl seen along the escarpment of the Range under

the red sandstone until we reach Jutana, where it occurs in great quantity and includes large stratified masses apparently of salt, along with broken up beds of gypsum. No salt is seen in the marl East of Jutana, though wherever it appears, its surface is covered with a saline efflorescence, and all the springs which issue from it yield a strong brine.

From this point it may be uninterruptedly traced to Pind Dadun Khan, in the neighbourhood of which it yields a very large amount of salt, and from thence with but a few breaks on to the Gredi Hills near Moosakhail, between which place and Booreekhail it is not seen. Here it again crops out and yields salt, and may be traced westward for some two or three miles into a ravine, which separates the Lukrukkie from the Majooch Hills. It then disappears and does not again, as far as we are aware, crop out, till near Maree on the Indus, where it forms an isolated ridge overhanging the river, along the right bank of which above the town of Kalibagh it is extensively developed, the salt appearing in immense stratified masses in the marl. Except for a few miles up to the Loon Nullah, which enters the Indus opposite Maree, we have not traced the marl northward, but probably the same formation yields the salt obtained at the mines in the Kohat district, which from the repeated attacks of the hill tribes have gained considerable notoriety.

At Maree and Kalibagh, the marl appears to have been subjected to great disturbance, and the red sandstone strata, which in other localities are immediately superior to it, seem to be wanting entirely. At Maree a few Tertiary sandstone strata, may be seen dipping as it were under the marl, and on the Kalibagh hill it seems entirely covered by Tertiary conglomerates and sandstones. As there is distinct evidence of a great upheaval and fracture of the rocks at Kalibagh, it is not surprising that the salt marl should appear to have suffered in the general disturbance, and to have as it were been forced up through the rocks, which in the regular order of things intervene between the Tertiary strata and the marl.

Its relation to the Tertiary rocks might induce the supposition, that at Kalibagh the marl was of Tertiary age, but its general appearance and mineral character are identical with the rock to the eastward, and leave no room to doubt that it is of the same age.

Besides the general outcrop of marl along the escarpment of the Range, we have noticed it under the red sandstone on the N. W., on the scarped side of mount Kuringali, the path between the villages of Chumbi and Vevhalee passing over it. Here no salt was observed, but the marl contains abundance of gypsum, and its surface is incrusted with the nsnal saline efflorescence. At the west end of the salt lake of Kullur Kuhar, the marl also occurs in small qnantity, appearing to have been forced up through the rocks immediately superior to it, and to be brought into contact with nummulite limestone by which it is covered.

At Vusnal to the north of Noorpoor we believe the salt marl with salt occurs in a deep ravine, but as we were not aware of the fact when in its neighbourhood, we never visited the locality. This, as far as we know, is the only spot where salt has been found on the north side of the Salt Range.

b. Lower Red Sandstone and Grit with Conglomerate.

Wherever the salt marl is seen at the base of an escarpment, its upper portion may be observed gradually to lose its brick-red colour, to become more like an indurated clay, and nltimately to pass into thin beds of dark red, fissile, argillaceous sandstone, which in some places alternates with thin beds of gypsnm and salt, and with green and chocolate-colonred clays.

This sandstone gradually loses its argillaceous character, its beds become thicker, its colour lighter and, by its constituents becoming coarser, passes freqnently into a grit. Conglomerate bands chiefly formed of bonlders of primitive rocks of moderate size, among which the prevalence of a red coarse-grained syenite is very remarkable, occur frequently, and present exactly the characters of the old red sandstone conglomerate of Britain.

The sandstone generally, but especially its lower beds, where they approach the marl, is highly hygrometric, and frequently presents on its surface a saline incrnstation.

It does not disintegrate in muriatic acid, but a portion dissolves with effervescence, the solution yielding to the nsual tests, abundant indications of carbonate of lime and carbonate of magnesia.

The ease with which this sandstone can be quarried is a strong

recommendation in its favour, though from its liability to become damp in moist weather, owing to its being impregnated with salt, it rapidly crumbles, and hence cannot be recommended as a durable building stone. If ever required for the purpose, the lighter coloured portions of the rock should invariably be selected, as they are less hygrometric than the darker variety.

No minerals of importance have been observed in this rock.

Although the most careful search was made, particularly in the lighter-coloured beds where fossils are most likely to be found, not a trace of an organic remain could be detected: when we bear in mind the fact that only a few years ago, the old red sandstone of Britain was regarded, "as the least fossiliferous rock in the geologic scale," our want of success in obtaining fossils from its Punjab representative, will not appear remarkable.

The thickness of this formation varies a good deal throughout the Range, and probably on an average is not less than 500 feet. The upper surface of the beds frequently present ripple markings, indicative of their having been deposited in shallow water.

c. Greenish micaceous Sandstones and Shales with grey Dolomitic Sandstone.

The red sandstone is generally succeeded by a series of greenish micaceous thinly laminated sandstones, dark shales and coarse calcareous bands, which in the eastern part of the Range are developed into an extensive deposit of a very peculiar sandstone, varying from nearly white to dark grey and weathering of a fawn colour. In many localities it is brecciated, the fragments having become recemented by a calcareous paste. A concretionary structure is by no means uncommon, masses of the rock appearing to be sometimes made up of nodules formed of concentric laminæ like the coats of an onion. Its lower beds are generally dark-coloured and parted by bands of micaceous sandstones and shales; brine springs not unfrequently issue from these and their impregnation with magnesia is evinced by the effervescence of sulphate of magnesia in fine acicular crystals, which may be often observed under the ridges of rock. When tolerably well developed, the united thickness of this formation must be about 500 feet.

The grey sandstone when treated with muriatic acid, dissolves slowly with effervescence, leaving a considerable residue of a nearly white silicious sand. On filtering this from the acid solution and applying to it the usual tests, lime and magnesia were found in abundance with a trace of protoxide of iron and alumina. The rock under notice is therefore a sandstone, the cementing agents being carbonate of lime and magnesia. Sometimes the two latter largely predominate, and give the sandstone more of the character of a coarse limestone. In a few of its beds, the cementing ingredient seems to be entirely carbonate of lime, and the examination of a specimen from one of these bands obtained at Baghanwala in 1848, which did not yield a trace of magnesia, led us to believe that this earth was not characteristic of the formation, which its appearance induced us to suspect.

A specimen of this sandstone from Mount Tillah yielded on analysis, the following results in 100 parts.

White quartz sand,	28.000
Carbonate of iron with a trace of alumina,	7.313
Carbonate of lime,	32.874
Carbonate of magnesia,	31.199
Loss,	.614
Total,	100.000

This sandstone or coarse magnesian limestone will, we are assured, be found to be most excellent and durable building stone, and it is much to be regretted, that it was not selected for the construction of the obelisk in the Chillianwalla burial-ground, the red sandstone of Pind Dadun Khan having been preferred. Though rather hard, it is easily worked, and when roughly polished, is highly ornamental from its possessing a semi-crystalline structure.

It may be had in abundance on mount Tillah, the summit of which it forms, and all along the Salt Range from Jelalpur to Mukrach, to the West of which place it gradually thins out in the micaceous green sandstone.

Like most calcarious rocks, it is liable to be acted on by water charged with carbonic acid, and hence along the upper weathered

surface of its beds, it is grooved and channeled in a most peculiar way by the rain water, which passing through the vegetation, acquires carbonic acid in considerable quantity, and becomes a most powerful natural solvent of lime and magnesia.

The only mineral which we have observed in this formation deserving of notice is galena or sulphuret of lead.

This occurs in the dolomitic sandstone, forming the summit of mount Kuringali, and in the same rock in a ravine near the temple on the right side of the Keurah gorge above Pind Dádun Khan. In these localities small cubical crystals are found scattered throughout the rock, but in very small quantity, and no where are there indications of a vein of any consequence. It is in great request among the natives as a cosmetic, to whom it is known by the name of Soorma.

Obscure carbonaceous markings are of frequent occurrence among the green micaceous sandstones, but too indistinct to be identified. They probably are the remains of fuci. In the dolomitic sandstone, no traces of organisms of any kind were detected.

d. Upper, red, variegated Sandstones, Grits, Conglomerates and Clays.

The dolomitic sandstone last described is succeeded by a series of dark red shales, argillaceous sandstones, including nodules of green clay, and quartzose grits with bands of conglomerates of primitive rocks, among which the same red syenite as occurs in the lower red sandstone is most abundant.

These beds are highly charged with peroxide of iron which gives them a blood-red colour, and magnesia may be detected in all the sandstones, grits, and conglomerates of the group in considerable abundance. All the sandstones are extensively ripple-marked, and along the water courses which intersect the beds, present on their surface a saline efflorescence.

Between Jelalpore and Pind Dádun Khan, they are largely developed, while towards the Indus they seem to be in a great measure replaced by a series of red, green, purple and chocolate-coloured shales which weather into clays, and from yielding small concretionary masses of copper ore, present considerable interest. These are invariably superior to the sandstone grits and conglomerates. Thin beds of white quartzose grit occasionally traverse the shales, and

beds of a coarse silicious sinter containing in some places particles of chalcedony are of frequent occurrence. Throughout the shales selenite or transparent gypsum may be noticed in laminæ and crystals, and in small impure concretions of radiating crystals, associated with similar nodular concretions of impure sulphate of barytes and argillaceous hæmatite. These along with the silicious sinter, have probably been deposited by thermal waters penetrating the shales, the variegated colours of which, may probably result from their having been exposed to different degrees of heat during the prevalence of thermal action. Such coloured clays are, we believe, of frequent occurrence in countries where thermal action is prevalent.

On tracing the shales upwards they gradually become arenaceous and acquire a greenish colour. A few dark shales then follow and mark the transition into the formation which succeeds.

Copper Ore.

The existence of copper ore in the Salt Range was first made public by Capt. Hollings, Deputy Commissioner of Leïa. It occurs chiefly in the form of nodular concretions, varying in size from a millet seed to that of a walnut, disseminated through the variegated shales and clays resulting from their disintegration, on the surface of which, particularly after rain, their green colour brings them prominently into view. Small green patches of silicate and carbonate of copper may also be observed in masses of the silicious sinter, which we before mentioned as occurring in the shales. The origin of this concretion is most obscure, but it is probable that the particles of copper in solution in thermal waters were diffused through the shales, and that by a process of crystallization they have aggregated into the form we now find them. Their resemblance to the nodular concretions of kuñkur found every where in the desert alluvial soil throughout the Punjab, induces us to believe that they were formed in a similar way. So complete, however, has been the separation of the particles of copper from the shales in which they are found, that not a trace of copper can be detected in them on submitting small portions to chemical analysis.

The nodules of copper ore are occasionally very pure, but frequently it forms only the centre of the nodular concretionary masses of sulphate of lime and barytes, which we have above alluded to.

No indications of the existence of a vein of ore have been obtained either in the shales or in any rock, superior or inferior to them. In the thin beds of coarse white quartzose grit which occur in the shales, disseminated grains of carbonate and silicate of copper are occasionally to be noticed, but in small quantity.

The ore is for the most part copper glance or sulphuret of copper, one of the richest and most easily smelted ores. Its surface is generally covered with copper, as the result of the action of air and moisture; indeed in a large number of the nodules, the copper glance can only be detected in their centre—their circumference being converted into carbonate of copper.

The purer and undecomposed nodules present on fracture a dark leaden-colour, and are sectile. Particles of the ore heated before the blow pipe on charcoal yield a button of metallic copper.

A pure specimen yielded, on analysis, the following results in 100 parts.

Copper, ...	75.830
Sulphuret of Soda, ...	3.155
Sulphur, ...	21.
Peroxide of iron and alluminæ, ...	.015
Total,...	100.000

The above analysis shows a much larger percentage of copper, than the concretions usually contain. This from a series of experiments, we believe, to vary from 12 to 20 per cent.

The quantity of ore seems insignificant, and is only interesting in a minerological point of view. After heavy rain, which disintegrates large quantities of shale, and leaves the green copper concretions exposed to view, a man may, in some localities, collect in the course of a day about an ounce of ore. It seems to be more abundant in some localities than in others. The Nulee hill above Kuttha yielding we believe the largest quantity. We have detected it in almost every deep ravine between Bayaar East of Moosakhail and Kuttha, a distance of not less than forty miles, within which limits the variegated shales are principally developed.

The only indications of organisms we have detected in this formation are confined to the dark red, schistose sandstones and upper

arenaceous shales. They are most indistinct and are probably the remains of Fucoids.

The rocks we have described under the term Devonian, form in thickness and extent, perhaps the most striking feature in the geology of the Salt Range, appearing in its steep escarpment subordinate to all the rocks hereafter to be noticed, and in the numerous ravines which intersect it.

On proceeding westward from Rhotas, they first emerge from under the miocene sandstones on the East flank of mount Tillah, the great mass of which they form, all the subdivisions of the series being duly represented in this mountain (see section No. 4) with the exception of the copper shales. From its West end they may be traced across the Poonah Nullah into the Chumbul Range, where they are flanked to the East by the miocene sandstones of the Imapore hills. On the Gurjah hill above Jelalpore, they are extensively exposed, and form the mass of the Range on to Baghanwalla, where the upper red sandstones attain their greatest thickness. From this point they stretch North for several miles, dipping under the table-land of Besharut and rising up again to form the summit and scarped northern face of mount Kuringali and Drengum, from where they may be traced into Diljubba, where they are for the most part concealed by the extensive Tertiary strata which stretch East to Buknala.

From Baghanwalla westward the Devonian rocks can be traced uninterruptedly. Around Kuttha the copper shales first appear, and seem in a great degree to take the place of the upper dark red sandstones, which can scarcely be recognized between that locality and Moosakhail, except in the neighbourhood of Chideru, where thick beds of them occur subordinate to the shales. From Moosakhail on to the Indus, the Devonian formations above the salt marl seem to amalgamate, and the divisions which are so distinctly marked in the East part of the Range can with difficulty be made out, the thickness of the whole gradually diminishing. They disappear altogether around Maree and Kalibagh.

In the Chichalee Range of hills on the West bank of the Indus below Kalibagh no Devonian rocks crop out, but at the North or up-

per end of the Kaffee Kote Range near the village of Bahadur Dak a series of red and grey saliferous sandstones appear for a short distance under carboniferous limestone. Numerous brine springs issue from these, which are doubtless the equivalent of the Devonian rocks East of the Indus.

Primary or Palæozoic Carboniferous Rocks.

Succeeding the formations last described are a series of limestones and sandstones which, from the abundance of marine organic remains they contain, furnish to the geologist a most invaluable aid in determining the age of various rocks inferior to them.

During the very partial examination of the Salt Range, which by orders of Government we made in the month of April 1848, we detected at Moosakhail on our return to Lahore from Kalibagh a developement of calcareous strata, which in our report we stated to be evidently superior in geological position to the salt marl. In a few hours devoted to the examination of this locality, a small collection of fossils was obtained, which were sent to England in order, if possible, to have them identified.

Through the kindness of Sir Roderick Murchison we effected this, and were informed by that distinguished geologist that, the Moosakhail fossils seemed identical with carboniferous forms well known in the British isles.

M. de Verneuil to whom my collection was submitted, identified 5 out of 8 or 9 species with forms well known in rocks of carboniferous age in other parts of the world.

The circumstance of our having detected what we took for belemnites and ammonites associated with genera characteristic of palæozoic formations, and misled by the idea entertained by geologists until very recently, that salt deposits were confined to Triassic or more recent rocks, we had great difficulty in bringing ourselves to believe that the Salt Range salt could possibly belong to a formation older than the Trias. The recent announcement, however, of the fact, that in North America the great salt sources issue from the heart of palæozoic rocks, and that in Russia the salt lies chiefly in the uppermost palæozoic deposit, and also in the Devonian sandstone, immediately removed all doubts from our minds as to the true age

of that of the Salt Range, as well as of the calcareous strata of Moosakhail.

The rocks included under the term carboniferous present in the Salt Range three divisions, which we shall proceed to notice.

A lower limestone, calcareous sandstone, and shales.

The lower beds of this deposit, when they rest on the Devonian rocks, generally present the characters of a calcareous sandstone of a light grey colour. This gradually passes into a limestone of a very compact and generally crystalline character, varying from a light flesh colour to dark grey, some varieties being nearly black. The beds of this rock, in which occur irregular shaped masses of hornstone, sometimes closely approaching to flint, are frequently parted by thin bands of arenaceous shales. There are frequently a mass of corals and corallines mixed up with shells. The limestones generally abound in encrinites and large brachiopodous Mollusca, and in many localities seem to be composed entirely of the disjointed stems of the former. Their fractured surface presents generally a highly crystalline aspect from the encrinite whorls being converted into calcareous spar.

Although generally a purely calcareous formation, in some localities, especially towards the Indus and in the Chichalee hills, it seems to become magnesian and to alter considerably in general appearance. Wherever magnesia prevails, the limestone assumes a cherty aspect, the strata are much disturbed, and frequently shivered, fossils become very scarce, and the same brecciated appearance as is noticed in the Devonian Dolomitic sandstone is very common. The occurrence of magnesia in the limestone is very local, and the same bed may be observed purely calcareous and full of fossils at one point, while half a mile beyond, it is charged with magnesia and scarcely a fossil to be found in it. Although the transition from a calcareous rock to a magnesian one is generally noticed along the strike of the beds, the same change may be observed in some localities extending in a vertical direction; such phenomena have been observed by Sir Roderick Murchison in the Alps, and it has been supposed that the magnesia, subsequently to the formation of such limestones, has been injected into them, and produced a metamorphosis. The absence of fossils too amidst the magnesian limestones has been

accounted for, by supposing that the mineral acid in union with which the magnesia has been introduced, has in accordance with the known laws of chemical attraction, combined with the calcareous matter of the fossils, and caused their disappearance. A similar theory to account for local deposits of gypsum in the midst of calcareous strata has also been propounded, viz. that vapours of sulphuric acid generated during the prevalence of igneous action, have been injected into limestones, and converted the carbonate into sulphate of lime. The origin of the Salt Range gypsum cannot, however, we conceive, be explained in this way; for if sulphuric acid vapours permeated the marl, they would in all probability have produced partial decomposition of the salt into sulphate of soda, an impurity not to be found in the mineral. The almost entire absence too of carbonate of lime from the gypsum, strengthens the belief that it was originally deposited as such.

On tracing the limestone upwards, its beds become thinner and less crystalline, and alternate with thin beds of dark magnesian micaceous sandstones and shales. At the upper limit of these in the central part of the Range and Chichalce Hills as well as at Kaffir Kote, a few thin beds of a compact slaty limestone generally of a dark grey colour occur, and seem to mark the transition into the next division.

b. Grey Sandstone and Shales.

The beds forming this series consist of micaceous fine grained fissile sandstones alternating with beds of dark bituminous shales. Towards their upper limits the sandstones become more compact and of a reddish colour, alternating frequently with beds of slaty limestone similar to those forming the top beds of the division of the series last described. In the upper compact sandstones, ripple markings are common, and in the Bukh Ravine above Moosakhail we detected a most distinct exhibition of markings similar to those produced by rain or hail falling on sand or mud, when in a wet or pasty state. These occur on the upper surface on a bed of sandstone, and were traced along its strike for a considerable distance. The bed dips under other beds of a similar sandstone which present

ripple markings on their surface, and hence we may safely conclude that it has been formed on a beach on which water has ebbed and flowed.

Rain-drop-markings similar to the above, have been noticed by Sir Charles Lyell in the states of Massachusetts and Connecticut in red sandstone of Triassic age.

In all the shales and in most of the sandstones of this series, magnesia prevails, and hence but few fossils occur, those that we have observed being confined to argillaceous sandstones in the immediate neighbourhood of calcareous beds, which are generally free of magnesia impregnation.

c. Upper Limestone.

The two preceding divisions of the carboniferous series are very distinctly marked wherever it is extensively developed, but east of the Indus there are few localities where the upper limestone is well seen. It forms the summit of the Zinnanee Hill above Chederos (see table No. 8) which is upwards of 1,900 feet above the plain. Here, in mineral character, it is undistinguishable from the more crystalline varieties of the lower limestone, and abounds in encrinites and brachiopoda. About ten miles further west in the Bukhh Ravine which intersects the Salt Range between Nummaal and Moosakhail a grey limestone of a hard and cherty character occurs in a similar position, but, as far as we are aware, devoid of fossils. Its lower beds assume the character of a very fine grained sandstone, and rest on a yellow argillaceous limestone of very fine grain, similar to some lithographic limestones. This limestone dissolves in acid with the separation of a considerable quantity of yellow mud, and its solution yields indication of the presence of a small quantity of magnesia: a few indistinct indications of fish scales were noticed in it.

On the Zinnanee Hill, the upper limestone is purely calcareous, and dissolves rapidly in muriatic acid, with the separation of a very small quantity of yellow mud. That of the Bukhh Ravine, however, dissolves slowly, and in its solution magnesia may be detected by the usual tests.

On analysis it yields in 100 parts:

Silica,	4.000
Carbonate of Lime,	69.200
Ditto of Magnesia,	25.809
Alumina with a little Peroxide of Iron,	.100
Organic Matter and Loss,	.891
Total,	100.000

The lower fine-grained sandstone on which the above limestone rests, yields on analysis as follows:

Silicious Quartz Sand,	36.000
Carbonate of Lime,	47.870
Ditto of Magnesia,	14.800
Alumina and Peroxide of Iron,	1.200
Organic Matter and Loss,	.130
Total,	100.000

On the west bank of the Indus in the Chichalee Hills, the upper limestone is far more distinct than on its east bank; and is generally cherty and magnesian, and much shivered and brecciated. In the Kaffir Kote Range, a highly bituminous sandstone of a dirty brown colour, appears to be its representative, from which large quantities of petroleum issue, this being probably derived from the spontaneous combustion of dark bituminous shales charged with pyrites, on which the sandstone rests, and which form the upper member of the middle carboniferous series.

Throughout the carboniferous rocks we have described, there appears no indication of true coal measures, which in Britain are invariably associated with the carboniferous or mountain limestone. The latter, in the south of England, forms the base of the coal formation, while in the Scotch coal fields thick seams of coal alternate with beds of carboniferous limestone and intercalated with limestone and sandstone beds of fresh-water origin. In the Salt Range, however, no fresh-water beds have been observed in the carboniferous series.

The limestones or marbles of this formation can be strongly recommended as highly ornamental and durable building stones.

The compact flesh-coloured and nearly black varieties are perhaps to be preferred, as weathering more uniformly than those which are more crystalline. They take a fine polish, and may be obtained in blocks of any size. Vurcha would be a covenient locality for obtaining the flesh-coloured stone, while in the Nursing Wan near Kuttha, the black variety could easily be procured. The flesh-coloured limestone forms the gateway of the ancient fort of Kaffir Kote, where it seems to have resisted the action of the atmosphere in a most remarkable degree, the blocks being as fresh as the day they were quarried.

As a source of lime, all the limestones of this formation are very valuable. The yellow argillaceous limestone mentioned as occurring in the Bukhh Ravine, is, we believe, well adapted for lithographic purposes, and shales of considerable size might with ease be obtained.

Petroleum, in the carboniferous formation, has been noticed only in the Algud Ravine at Kaffir Kote, where it exudes in considerable quantity from the upper brown bituminous sandstone, which is highly charged with it; where springs issue from the sandstone in the small ravines which intersect its beds, large holes are dug which rapidly fill with water mixed with Petroleum. This from its lighter specific gravity rises to the surface and forms a scum, by passing bunches of grass through which, the Petroleum or Salira as it is called, adheres, and is removed into gurrahs or earthen vessels placed for its reception.

Notwithstanding its most offensive smell, it is burnt by the natives in their lamps. It is also in great demand among the owners of camels, who extol its virtues as an external application to sores and the common cutaneous diseases to which that animal is subject.

Sulphuretted hydrogen springs issue from the carboniferous limestone in several localities. In the Bukhh Ravine one issuing from the upper limestone indicated a temperature of 94° when the air was 71° in the month of February. The water on escaping from the rock, deposits sulphur, and gives a copious black precipitate with a solution of acctate of lead.

Fossils are very numerous throughout the formation.

The lower beds abound in Brachiopodous molluscæ, crinoidcæ,

corals, and corallines; of Brachiopoda shells, the genera Producta, Orthis, Spirifer and Terebratula are most abundant. Along with the Brachiopoda we have obtained one or two Gasteropoda, but these are generally scarce.

In several localities we have found large spines of a species of Cidaris, some of these being very perfect and tuberculated, the articulating end of the spine being well preserved.

Though this is the case, the shell of the animal occurs but rarely, and only, as far as we have observed, in comminuted fragments.

The abundance of crinoideæ is very remarkable, whole beds of rock being built up of encrinites, the whorls of which are frequently of large size, and occasionally are found in connection with their lily head.

Towards the upper part of the lower division of the series, where the limestone becomes argillaceous and thin-bedded and alternates with coarse arenaceous shales, the Brachiopoda become scarce and give place to Cephalopoda, which animals characterize a marine zone of less depth than the Brachiopoda which precede them, and generally occur in seas with muddy bottoms. We have obtained examples of species of the genera Bellerophon, Goniatites (?) and Orthoceras. Associated with these large spiral univalves of the genus Cirrus and Enomphalus are abundant, and, in the slaty limestone at the top of the lower division of the carboniferous series, and also in the middle division, a Cephalopodous shell formerly considered an ammonite, but now constituted into the genus Ceratitis abounds, and is generally associated with a small bivalve, probably a species of Passidonia. As Ceratites have hitherto been considered as characteristic of rocks of triassic age and peculiar to the muschelkalk, their occurrence in company with undoubted carboniferous types is highly interesting. We have placed the matter beyond doubt, having in our possession a specimen* which we obtained at Moosakhail in which two Orthoceratites and seven Ceratites are lying side by side in a slab 9 in. × 5 in.; Orthoceratites have never been found

* Through the kindness of Cavendish Johnson, Esq. Asstt. Surgn. 3rd Regt. N. I. we are enabled to submit a drawing of this most interesting specimen, which we believe to be unique in the annals of Geology.

in strata superior to the carboniferous limestone, but abound throughout the older fossiliferous rocks.

Fossils having a considerable resemblance to belemnites occur in the carboniferous limestone associated with the fossils we have alluded to. What they really are, we are unable to determine; but as a set of specimens were sent home to England in March, at the request of Sir Roderick Murchison, we trust soon to hear the result of his examination of them. The exact determination of their nature is of considerable importance, as there is perhaps not a more established fact in geology than that belemnites are confined to strata which succeed the trias; abounding in the seas, oolite and chalk, after which they disappear from the page of geologic history.

In the same flag limestone in which the Ceratitis occurs, Icthyolite remains were obtained in the shape of small sharp and finely striated teeth covered with a shining brown enamel, small fragments of bone and one or two scales have also been procured, the identification of which as well as of a rather extensive collection of fossils from the Salt Range, cannot be effected in our present position with neither collections nor books of reference available. The whole collection will be sent home to England, where the fossils can be satisfactorily examined.

The following species of shells from the Moosakhail limestone were identified in 1849, by M. de Verueuil.

Producta	Cara. D'Orbigny.
„	costata. Sowerby.
	Flemingii. Sowerby.
Orthis	crenistria. Phill.
Terebratula	Royssii. L'Eveille.

On the above, Sir Roderick Murchison remarks, in a communication addressed to the Geological Society in December 1850, "these fossils have already been known to have an enormous geographical range, the Producta Cara. occurring in Peru, Spitzbergen, northern Europe and the Sierra Morena of Spain, whilst two or three of the other species, have an almost equally extensive distribution."

The carboniferous formation, the thickness of which, when well developed, is probably not less than 1800 feet, is entirely confined

to the central portion and western end of the Salt Range. It first appears at Noorpoor in the Nilawan ravine, where a thin bed of a crystalline grey limestone containing a few Encrinites and Terebratulæ, may be seen resting on purple Devonian shales and covered by a ferruginous claystone which marks the base of the nummulite limestone formation, to be hereafter described. On tracing it westward it gradually increases in thicknsss. Productæ and Spiriferæ appear, and in some places literally swarm. At Kuttha it is extensively developed in the Nursingwan, where high cliffs of it may be seen resting on Devonian rocks.

Between Kuttha and Moosakhail, it perhaps attains its greatest thickness, frequently appearing in scarped precipices and forming the mass of the hills which intervene between the south side of the Salt Range and the Sam-Sekisur valley.

In this district rocks, probably of an oolitic age, appear between the carboniferous ones and the nummulite limestone, and this relation may be observed on to the Indus and in the Chichalee hills.

For a short distance on both sides of the Indus near Maree and Kalibagh, the carboniferous rocks disappear; but at Kooch about four miles North of Kalibagh, they again crop out at the base of the Chichalee range, and may be traced south to near Mulakhail, where they are covered up by the oolitic and tertiary formations.

They again appear on the right bank of the Indus below the village of Bahadur Dak, and constitute the greater part of the Kaffir Kote Range, (washed by the Indus,) beyond the upper part of which we have not traced them. As this Range stretches south and is evidently a branch from the great Soohinan Range, it is probable that the carboniferous rocks occur there also, but the hostility of the hill tribes in its neighbourhood will, we fear, for years to come prevent any attempts to gain a knowledge of its geological structure.

In the Kaffir Kote Range, as far as we have had an opportunity of examining it, the carboniferous rocks are immediately in relation with tertiary sandstones and clays, no nummulite limestone or Oolitic rocks intervening; unless the bituminous brown sandstone, which we now consider the representative of the upper member of the carboniferous series, should turn out to be Oolitic.

Secondary Oolitic Rocks.

a. Yellow, iron-stained, quartzose sandstone, grits and bituminous shales.

Resting on the upper carboniferous rocks and separated from them by a few thin beds of a yellow argillaceous limestone, there occur a series of fissile argillaceous sandstones, and coarse quartzose grits and sandstones, generally of an incoherent character, alternating with beds of black bituminous shales charged with iron pyrites. The prevailing colour of the sandstones is a sickly yellow, derived from impregnation with peroxide of iron. Masses of fossil wood converted into jet are abundant, both in the sandstones and grits. These also in some places occur in the shales, which, where exposed to air and moisture, are in a constant state of decomposition from the oxidation of their contained pyrites. So violent is the action and so great the heat produced, that sometimes the shales undergo spontaneous combustion, and whole beds may be observed either converted, or in process of being so, into a ferruginous claystone of a dark red colour, which occasionally presents a kind of concretionary structure.

In the neighbourhood of these decomposing shales and claystones, the sandstones and grits acquire a whitened and baked appearance, and the masses of jet they contain, are frequently converted into coke.

Where the shales are moist, their surface is generally incrusted with an efflorescence of sulphate of iron and alumina, which strongly impregnate the water of springs which issue from them in some ravines, and which on exposure to the air, deposits on the ground over which it flows a crust of hydrated peroxide of iron. In some of the shale beds in the upper part of the series, a magnesian efflorescence has been noticed, but the sandstones and grits seem altogether free of magnesian impregnation.

The lower argillaceous beds occasionally contain very perfect impressions of the delicate fronds of ferns, converted into black carbonaceous matter. These are doubtless of fresh water origin and, from the fineness of the sand and mud of which they are composed, must have been deposited in still water.

The grits which succeed them and contain masses of jet are also probably of fresh-water origin, but the fact of the latter being found only in masses, which are evidently portions of the trunks and

branches of trees, and invariably in a horizontal position, affords proof that they have been transported from a distance along with the coarse materials forming the grits.

No marine organic remains occur throughout these beds, which are succeeded by others of undoubted marine origin, and differing greatly in mineral character.

b. Cherty thin bedded limestones with shales.

The sandstones, &c. last described gradually acquire calcareous matter, and pass into fine grained limestones of a cherty character, varying in colour from nearly black, to a pale yellow. East of the Indus, these beds are of little thickness and contain very few organic remains.

At Kalibagh and in the Chichalee hills they alternate with yellow calcareous sandstones and dark bituminous shales and attain a thickness of three or four hundred feet in some localities.

Marine organic remains are abundant, particularly in the upper limestones, and some of the intermediate beds are a mass of comminuted shells.

Throughout the Chichalee Range a very singular brown calcareous bed occurs near the bottom of the series, in which small globules of a bright metallic lustre may be observed mixed up with comminuted shells. On treating a fragment of this rock with muriatic acid the calcareous matter rapidly dissolves, leaving the globules in the form of a coarse sand, the particles of which have a highly polished surface, and have all the appearance of being the debris of hypersthene rock.

No distinct oolitic structure prevails throughout the limestones, which differ totally in appearance from those of the carboniferous rocks. Some of them bear a close resemblance to the limestones of the lias formation.

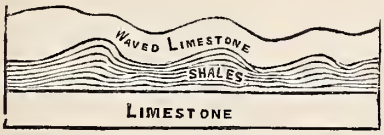
They are hard and splintery and present a conchoidal fracture. When bruised, the darker varieties emit the odour of sulphuretted hydrogen.

They dissolve rapidly in muriatic acid, leaving a considerable sediment of silica in flakes mixed with a little organic matter. They contain a little carbonate of iron with a trace of alumina, but no magnesia when undisturbed. At Kalibagh, however, where large masses of the limestone repose on salt marl, they have a remarkably shivered

appearance, and magnesia may be detected in them in small quantities. A specimen of the limestone of a dark grey colour from Umlakhail in the Chichalee Range yielded on analysis the following results:—

Silica with a little organic matter, ...	3.00
Carbonate of iron with a trace of Alumina, ...	1.70
Carbonate of Lime, ...	95.70
	100.40

At Umlakhail a bed of argillaceous limestone occurs presenting on its upper surface a series of waves passing across the bed at right angles to its strike. These are about $1\frac{1}{2}$ feet apart, and their crest about two inches above the general level of the bed. It presents the appearance represented in the annexed figure. A bed of shale, which occurs beneath it, is, for a short distance, affected in a similar way; but the surface of a limestone bed on which the shale rests, is perfectly horizontal, and does not seem to have suffered in the least from the lateral compression to which the upper bed has been subjected. The force exerted seems to have been nearly sufficient to have fractured the bed, as, along the crests of some of the waves and parallel to these, cracks may be observed extending some depth into the bed, which is not more than two feet thick. It is difficult to imagine how any lateral force could have been applied, so as only to affect one or two beds. The condition of the beds superior to the waved one could not be ascertained, on account of the amount of debris with which they were covered.



c. Green Belemnite, Sandstone and Shales.

In the Salt Range east of the Indus the limestones last noticed are succeeded by a thin bed of yellow quartzose grit, containing a few fragments of jet. At Kalibagh and in the Chichalee Range a series of black bituminous shales succeeded by a dark green somewhat incoherent sandstone intervene, presenting a thickness of four or five hundred feet. The latter is full of pyrites, which rapidly decomposes after rain, sulphurous acid being given off in quantity at times sufficient to be disagreeable.

Small fragments of jet occur in the sandstone, and both in it and the shales, belemnites, and ammonites occur in great abundance. These fossils are of great interest, as enabling us to fix the age of the formation.

All along the Chichalee Range the belemnite shales and sandstone are well developed, and are succeeded by the quartzose grit noticed above, which apparently contains no fossils.

In the oolitic formation there are no building stones of any value; but many of the limestones are valuable as a source of lime.

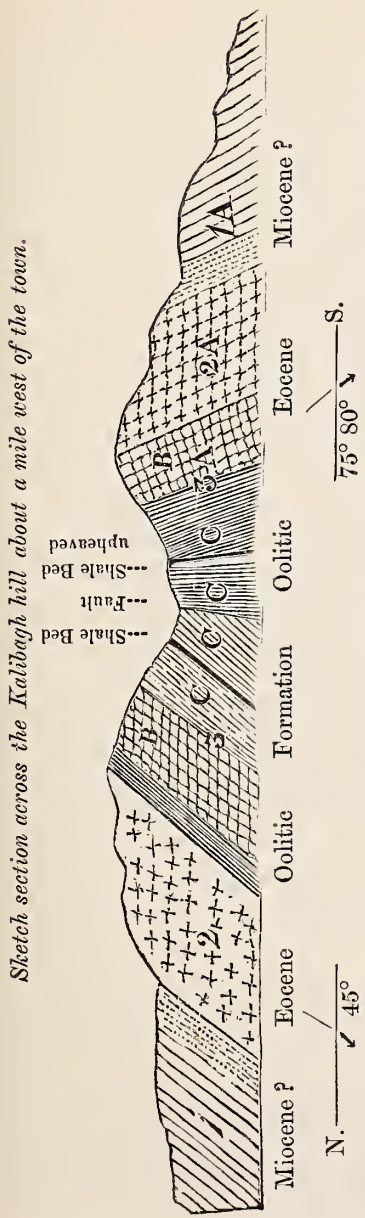
Of minerals, we shall notice the bituminous shales, iron-alum, jet or fossil wood and argillaceous iron-stone.

The bituminous shales which alternate with the sandstones and grits are occasionally used at Kalibagh in the preparation of alum. Some of them are well adapted for this purpose, but, generally speaking, they are very inferior to the shales of the nummulite limestone formation to be hereafter described.

Iron-alum forms, as before mentioned, an incrustation on the surface of the bituminous shales and masses of jet which contain iron pyrites in a state of decomposition. It is called "kaie" by the natives and is extensively used by them, when mixed with an infusion of pomegranate or other astringent bark, containing tannin for the preparation of a black dye. Its colour is white with a tinge of yellow. It gives a strong acid reaction, and has a most powerfully astringent taste. Peroxide of iron and alumina are indicated in its solution, by the usual tests, in union with sulphuric acid. In the Bukkh Ravine at Moosakhail, it is collected in considerable quantity.

Fossil wood in this form of jet occurs in too insignificant quantity in the Salt Range east of the Indus to have attracted much attention. In a ravine, however, about a mile west of Kalibagh, it occurs in considerable abundance, and under the designation of Kalibagh coal has been employed within the last two years to some extent as a fuel in the Indus steamers. Its existence was, we believe, first brought to the notice of Government by Burnes and Wood, and has since been reported on by Dr. Jamieson and myself.

It is found in lumps of various sizes in dark bituminous shales alternating with yellow sandstones; but nothing like a seam has been detected, though films of bituminous coal may in some places



be seen in the shales. The masses of coal are generally compressed, and are evidently portions of the trunks and branches of trees, the point of junction of the former with the latter being often apparent.

Though distributed throughout all the shale beds, the coal occurs most abundantly in one of these, which is from six to eight feet thick, and is enclosed between beds of yellow sandstone, in which masses of the coal also occur. It has for the last two years been chiefly obtained from the shale-bed at a point where owing to a fracture and upheaval of the strata, a portion of them have been thrown into a nearly vertical position, as represented in the annexed rough sketch.

Line of section from north to south distance about 1 mile.

1 Conglomerate, soft sandstone and red clays.

2 Nummulite limestone and alum shales.

3 (A.) Belemnite shales (B.) cherty limestones.

(C.) Quartzose sandstones and grits with beds of bituminous shales.

3 A., 2 A. and 1 A. The same beds in reversed order.

By digging a succession of holes at different heights in the vertical shale-bed, the masses of coal are obtained with much greater ease, than where the bed in a

regular position dips to the north at an angle of 45° under the superior rocks.

In the vertical bed a gallery has been sunk to the depth of fifty feet in hopes of discovering a seam of coal, but, as was to be expected, with an unfavourable result. Indeed, the labour expended in digging the gallery has not been rewarded, by obtaining a larger quantity of coal, the masses of which, we were informed by the miners, became less numerous and more difficult to detach from the shale the deeper they dug. As it is most probable that the wood now connected with coal has been drifted from the spot where it grew, it is natural to infer, that the masses of it would accumulate more abundantly in some places than in others, just as drift wood does on the bank of a river. This appears to be the case at Kalibagh, as in some places the shale contains numerous masses of coal, while at others scarcely a fragment is to be detected.

The coal has a bright glistening appearance, is very hard and light, and exhibits a conchoidal fracture in which its woody structure is most apparent. It is of a jet-black colour, has a brown streak, and often incloses nests of half decomposed wood resembling peat. The surface of the coal often presents small crystals of gypsum, and imbedded masses of iron pyrites are by no means uncommon.

It burns quickly, without coking, to a light coloured ash and emits a large amount of yellow smoky flame; on being distilled it yields a light spongy coke of a glistening metallic colour with a large quantity of inflammable gas. On analysis the following results were obtained in 100 parts:

Carbon (coke), ...	37.5
Volatile bituminous inflammable matter, ...	60.0
Ashes (Silica), ...	2.5
Total,	100.0

The large amount of volatile bituminous matter as compared to that of coke, at once refers this coal to the class of lignites or coals in which the vegetable matter is imperfectly carbonized. In its small amount of ash (which in some specimens we have found as low as 1.66 per cent.) it differs remarkably from most of these, but the solid nature of the wood forming the coal, not admitting of the infiltration of earthy matter may account for this.

In an analysis, however, such as the above, the amount of ash obtained will invariably be less, than if a large sample of the coal were operated on, as the masses have invariably attached to them portions of the sand, clay, &c. in which they were imbedded. These mechanical impurities fusing and forming a slag or clinker in furnaces during the combustion of the coal, have been found troublesome.

The Kalibagh coal is for ordinary steam purposes an excellent fuel, but not an economical one, on account of the rapidity with which it burns.

The real evaporative power of coals is in the direct ratio to the amount of carbon or coke they contain, and hence as good English coal yields from 50 to 70 per cent. Kalibagh coal should have only half their evaporative power, and about twice that of the ordinary woods used as fuel in the Indus steamers, which yield from 16 to 18 per cent. of solid charcoal.

The coal can only be procured in small quantities at a time, months being required to collect a few hundred maunds. During 1850 about 2,500 maunds were dug, and from the 27th March 1851 to the 11th March 1852, 2,126 maunds were turned out and landed at Kalibagh on the right bank of the Indus, at the rate of eight maunds for the Rupee, a rate which never can remunerate the miners for any length of time for the labour required to extract the mineral.

The ordinary small Indus steamers consume English coal at the rate of 600 lbs. an hour when steaming, and hence on the supposition that double the quantity of Kalibagh coal is required, 200,000 lbs. (2500 maunds) the out turn of coal for one year at Kalibagh would only keep one vessel steaming for 166 hours. We see no prospect of the supply of coal increasing, nay the quantity obtainable, as far as we could ascertain from intercourse with the miners, seems gradually decreasing.

In the absence of any thing like a seam of coal at Kalibagh, we do not consider it expedient for Government to spend money there in sinking exploratory shafts.

The coal has all to be carried on bullocks, mules or donkeys from the pits to Kalibagh over a tolerable hill road, but as it is very hard it stands carriage remarkably well.

Clay ironstone has not been observed East of the Indus, but in

the oolitic shales at Musakhail, in the Chichalee Range we detected several thin beds of it, none of which exceeded $1\frac{1}{2}$ or 2 inches in thickness.

It is of a dark grey colour and has a high specific gravity.

It dissolves with slight effervescence in aqua regia, leaving a considerable residue of dark mud. The solution is of a dark yellow colour and gives with ammonia a dense brown precipitate of peroxide of iron mixed with a little alumina.

It is therefore analogous to the block hard ironstone of Scotland, which, occurring as it does in connection with coal, is perhaps one of the most valuable iron ores known.

It would be interesting to ascertain if this ore is ever used at Kunecgoornul by the Wuzeerees, to yield the iron manufactured there, and which is brought into Kalibagh for sale in lumps of very coarse pig iron. We believe hæmatite ore is chiefly employed, but from what rock it is procured, we could obtain no information. Charcoal is used for the smelting of the ore, no other fuel being accessible.

The beds of clay ironstone above noticed are too small to be of much practical importance, and, even did thicker beds exist, the want of a suitable fuel for the fusion of the ore, would prevent its being smelted at any thing like a remunerative rate.

In the lower argillaceous sandstone beds of this formation, we obtained at Moosakhail and also in the neighbourhood of Kalibagh very perfect carbonaceous impressions of the delicate fronds of a small fern, probably a species of Pecoptaris. These were associated with small pieces of brown coal, which are evidently the compressed stems of soft vegetables. Their remains, however, were too indistinct to admit of their being identified. The masses of jet described as Kalibagh coal present on fracture a woody structure similar to that of the wood of Coniferæ or Cycadaceæ, numerous concentric circles of growth pierced by medullary plates being apparent in most specimens. Some Peeteus, Ostreæ, Terebratulæ and fragments of Echinidæ occur in the limestones, in the upper beds of which a few belemnites were detected.

These latter however abound in the shales and green sandstones which succeed the limestone, and are associated with Ammonites, Grypheæ, Plagiostoma and saurian remains.

The number of belemnites in the shales in some places is quite wonderful, and two species at least occur. The alveoli of the belemnites are frequently found attached to the osselit, and in their interior the casts of the chambers of the alveolus or phragmacone. These are often found detached, and when seen in the rock, have much the appearance of an orthoceratite, being composed of concave or convex discs, fitting one into the other, and having thin articulating surfaces highly polished. Indeed were it not for the want of a siphuncle and the ease with which a disc can be separated from its neighbour, the similarity to an orthoceratite would be complete. Each disc seems entirely disconnected from its fellow; but no partition of the original chambers could be detected between them, the convex surface of the upper disc being capable apparently of free movement on the concave surface of the lower one, as in a ball and socket joint. These discs are sometimes of large size, one specimen which we procured being two inches in diameter.

Ammonites, though occurring in the shales, are most abundant in the green sandstone. They are generally ill preserved and are liable to fall to pieces in extracting them, having been acted on by the sulphurous acid, which is generated in the sandstone by the decomposition of pyrites. Two or three species have been procured.

Of the genus Gryphea, we have obtained probably two species, one of which closely resembles the G. incurva. They are generally ill preserved.

A large bi-valve, probably a species of Plagiostoma, is very abundant in the green sandstone, but good specimens are with difficulty procurable.

In some places bones and teeth of saurians occur in the sandstones, but are no where plentiful. The bones are generally fragmentary, very brittle and crumbly. Nothing like a complete skeleton was observed, the most perfect relic obtained being a portion of a scapula attached to a bit of a humerus. The teeth are better preserved than the bones, but are also very brittle. They are covered with a dark brown enamel, are compressed, sharp pointed and beautifully striated on their surface. One, which we found, but which fell into fragments in attempting to extract it, was at least three inches long and about an inch broad at the base. The decomposition which the

sandstone is undergoing near the surface, destroys rapidly the fossils which are imbedded in it, and hence, to obtain good specimens, the fresh rock must be quarried. This we had neither the time nor means of doing at our command, and hence were reluctantly forced to be content with such specimens as we could procure from the decomposing rock.

A claw, apparently of a crustacian, was observed in the sandstone, but it fell into fragments in digging it out.

All the fossils we have noticed are characteristic of the lias and the oolite; but from the general aspect of the rocks we have described, we are inclined to refer them to the latter formation. The green sandstone and shales are probably analogous to the Oxford clay; but an examination of the fossils by competent palæontologists can alone decide the point.

A formation abounding in oolitic fossils similar to those we have noticed, has been described by Capt. Grant, Bombay Engineers, as occurring in Cutch, and Capt. Strachey has also detected a like formation in the Himalayas, both on their Indian and Thibet sides. In the Rajmahal hills Dr. McLelland, on the slender evidence afforded by the existence of a few species of fossil plants of the genera Zamia, Tæniopteris and Poacites, refers "certain greyish and bluish white indurated clays, rendered slaty in places by the abundance of leaves of plants they contain," to the inferior oolite.

No oolitic rocks appear in the Salt Range in its eastern part. In the hills South of Koofree at the West end of the Sone Sikesur valley, a few shales and sandstones here and there appear under the debris of nummulite limestone rocks. Their thickness gradually increases in a westerly direction; and, on the steep south-east side of mount Sikesur, the oolitic strata are distinctly seen between the carboniferous limestone and nummulitic rocks. From mount Sikesur they may be uninterruptedly traced towards the Indus, preserving throughout a remarkably uniform character. From Kalibagh they stretch round into the Chichalee Range, preserving the same relations as in the Salt Range, but are of great thickness. Excellent sections of them are obtained in the Chichalee pass and in the Ravines between that and Mulokhail; about six miles below which they seem to throw out and to be covered up by nummulite lime-

stoue. They do not appear in the upper part of the Kaffir Kote Range as far as we have observed, but it is probable that oolitic strata agaiu re-appear in the Sooliman Rauge, as we have seen belemnites brought by natives from the hills near Dera Ghazee Khau. These may probably be an extension of the Cutch strata before alluded to.

(To be Continued.)

Supplementary Notice on the new Mineral Resin, Hircine.—*By* Henry Piddington, *Curator Museum of Economic Geology.*

My first notice of this singular and new substance will be fouud in the Journal No. I. of 1852, p. 76.

Being in correspondence on other matters with Dr. Dawson of Raugoon, so advantageously known in Calcutta by his humane establishment of the Seamen's Hospital at that port, I sent him a minute fragment from our specimen, requesting he would be good enough, if he did not know it, to make enquiries regarding it. His answer just received gives so clear an account of what it is, that I thiuk it well worth putting upon record. It will be seen that my conjecture as to its being a mineral Resin was correct, aud we have thus one more added to the list of these singular and mysterious substances. Dr. Dawson writes as follows:

"By the arrival, the other day of 'Fire Queen,' I was put in possession of your kind note, dated December the 12th accompanied by a specimen piece of the new resinous Mineral 'Hircine,' and the paper which you had written and printed upon the subject.

"As early as June 1851, this particular substance attracted my attention, in connection with a miscellaneous collection of minerals, metals, models of machines and a variety of domestic articles, I was then engaged in making, for a Museum in Philadelphia. I found it in the bazar in rather small bits, in the shops of some of the Burmese druggists. This miueral I am informed, is procurable in Burmah, in that section of the country which abounds in the celebrated

petroleum wells. It is dug up out of the ground, at a considerable depth, ranging from one to two hundred feet below the surface. The day before yesterday, an intelligent Burman mentioned to me, that he once saw, not longer, he thought, than four years ago a lump of it about 5 Viss in weight, obtained in that locality, after a great deal of trouble in digging, as a specimen for the present king of Ava. It seems to have two names among those who are acquainted with the article, our name is *Khouk* a stone, and *pa young* —wax; stone wax. The other is, *perai-yet*, which has no particular meaning that I can learn. I have been also told, that there is another variety of this identical substance, which is of a high translucent colour, somewhat resembling spermaceti. It is derived, the natives tell me, from the same district, though I have never seen any of it. One is commonly called the *white* kind, the other, or that which you have experimented upon being the '*black*' *sort*. The Burmese, it appears apply it to no special purpose, either in medicine, or the arts, but the alchemists, a class whom we still find in this part of the globe; employ it in their attempts to effect the transmutation of the baser metals.

"Before the war commenced, and the consequent destruction of Rangoon, a few pieces of the brown kind could have been readily picked up in the druggists' shops, but now after a most diligent search, I regret to say, that not a single specimen of it can be found. Hereafter when the country above Prome is open to traffic, it will naturally find its way down to our bazar as formerly, when I shall not fail to remember your request.

"If it would not be giving you too much trouble, would you be so kind as to send a copy of your paper on 'Hircine' to my friend, Professor James Bryan, M. D. Corner of Tenth and Arch Streets, Philadelphia, U. S., to whom the specimens I have already referred to were forwarded. The gentleman who may examine them, will thus be made aware of the researches you have instituted upon the subject of this new mineral."

The ancient City of Kansonapuri now called Rungamutty.—By Capt. F. P. Layard.

Twelve miles South of Moorshedabad, on the right bank of the river Bhaghirutti, rise the high red* cliffs of Rungamutty, on which at present stands an extensive village peopled by many busy families employed in the neighbouring silk Filatures.

About six or seven years ago the river, in its ever changing course, commenced impinging on the Rungamutty cliff, which at length became undermined and fell in large masses, exposing many ancient foundations of walls, deep wells long filled up with the earth of ages, and, as usual in exhumed eastern cities, innumerable fragments of pottery. These remains, together with the traces of numerous old tanks and mounds, scattered over the low plain, lying between the high ground of Rungamutty and the village of Gowkurn, about four miles distant, had long impressed me with the idea that some old forgotten city had once occupied this spot.

My suppositions were confirmed on perusing Major Wilford's able Essay on the Gangetic Provinces, contained in the IX. vol. of the Researches of the Bengal Asiatic Society. He there states, according to information furnished by Lieut. Hoare, that by tradition, the king of Lanca, (representing either Ceylon or Java) invaded the country of Bengal with a powerful fleet, and sailed up the Ganges† as far as Rungamutty, then called Cósumapurí, a considerable place where the Mahárájá of Bengal often resided, and that the invaders plundered the country and destroyed the city.

If my informants are correct, Lieut. Hoare must have given the name under a misapprehension of sound, as I was careful to have the name written before me in the native character, which distinctly read Kansonapuri or Kurn-sona-ka-ghur, the city of the golden ear. The tradition relating to the visit of the king of Lanca was also given to me, but with a different version.

The city of Kansonapuri is said to have been built many hundreds

* Composed according to Capt. Sherwill of red and yellow ferruginous tough clay, embedding nodules of pisiform iron ore and black mica (decomposing).

† Evident traces exist of the Bhaghirutti having, at this spot, been formerly the main bed of the Ganges, before it changed its course towards Bauleah and Pubna.

of years ago, by a famous Mahárájá of Bengal named Kurn Sén, who resided chiefly at Gour. He erected also a country palace about four miles distant, which was called after him Gowkurn from the circumstance of his ears being of gold and shaped like those of a cow!

Many interesting spots connected with legends and traditions of the ancient city are still pointed out, such as the Demon's mount and the Rajbarree or palace of Kurn Sén. The remains of the moat of the Rajbarree are distinctly traceable on three sides, although now under cultivation; the fourth has disappeared in the river. On the eastern face of the Rajbarree, stood, a few years ago, the ruins of a very ancient gateway with two large entrances, called by the people of the neighbouring village of Juddoopore, Boorj or the tower; it has entirely disappeared, having crumbled away with the falling bank into the rapid stream below.

Near this spot on the margin of an old tank called Bél Talao, is said to have stood the Cutchery or Court of Justice of Raja Kurn Sén.

West of the factory, near a tank called Jummoona Talao, was the Puttur Ghur or stone fort, in former days, overhanging the river; nothing now remains of this building, but a low mound indicating its site and numerous fragments of stone. A curious six-armed image was found in the bed of the tank some years ago, and transferred to the foot of the magnificent Banian tree at Rungamutty, where, I regret to say, it has been sadly mutilated and destroyed.

It represents a figure kneeling on one knee, and is said by the people of the place to be Bemi Ka Thakoorain, but I should fancy the goddess Káli is intended. The two outer or front arms have been broken off, the centre right arm apparently holds what may have been a human victim suspended by the feet, but the object is too much injured to form any correct idea of its original shape. The hinder right arm is in the act of drawing an arrow from a quiver suspended at the back of the goddess, whilst the corresponding arm on the left holds the bow. The centre left arm appears to support a lotus flower or other insignia, but the upper part of the figure has been too much mutilated to trace any thing correctly.

I annex a little sketch of the stone to illustrate the description.

Black stone Image found in the Jummina Talao at Ruvganutti

On the Site of the ancient City of Kunsana-puri

Abstract of a Journal kept by Mr. Gardiner during his travels in Central Asia—with a Note and Introduction.—By M. P. Edgeworth, *Esq., B. C. S.*

As every contribution to the geography of little known regions is interesting, I submit the following extracts and abstract of a journal kept by a Mr. Gardiner. These journals were lent by him to the late Sir Alex. Burnes in Cabul, and but partially recovered. They were written, he informs me, mostly on scraps of paper at the time, and during a subsequent residence in Cabul thrown into the shape they now have, occupying several volumes of country paper. Two volumes remained in Col. Burnes' hands, and were lost at the time of the Cabul disasters. One of these unfortunately, related to the journey through Cafferistan. The route taken by Mr. Gardiner is in most parts quite different from that followed by any European traveller; he merely crosses the routes of Lieut. Wood and Mr. Moorcroft; the late travellers Messrs. Winterbottom, Agnew, and Lieut. Young, in 1848, penetrated into Gilget, and the boundary Commissioners, Messrs. Cunningham and Strachey with Dr. Thomson, came on his route near the Kara Korum, leaving the central region traversed by Mr. Gardiner still unexplored.

I have not made any attempt to compare the routes and inductions of Mr. Gardiner with those travellers, as I have neither the materials nor leisure requisite for the purpose; I give a bare abstract of his route with brief descriptions of the country and remarkable objects. I also give one specimen at greater length of his visit to one very remarkable spot. I cannot but think that were Mr. Gardiner's rough materials placed in good hands, and the losses above noted replaced, a most interesting book of travels might be constructed.

February 9th, 1853. M. Pakenham Edgeworth.

Introduction.

Mr. Gardiner is son of a Dr. Gardiner in the Mexican service. He was educated for several years at the Jesuit College of Clongoose in Ireland. On his father's death in 1823, he left Mexico with the intention of joining his elder brother, who was in the Rus-

sian engineering service at Astracan, in a Portuguese brigantine for Lisbon.

There he met with a Mr. Aylmer connected with the Principal of Clongoose, who induced him to go with him to Egypt. Mr. Gardiner then became acquainted with Messrs. Datterwitz, two German mineralogists, and another M. Musaix, a Frenchman, and travelled with them overland to Astracan, joining the Diarbekr caravan returning from Mecca to Tribizond, thence by water to a roadstead between Vudaun and Kark. Thence by land to the north of the Caucasus—misguided, they were in great danger from the natives at Anacuck, but escaped and reached Georest and Astracan in safety. Found his brother living in the island of Kumchnoe opposite Guricoe.

Mr. Gardiner remained there till 1829, preparing himself for the Russian Engineers, when all his prospects were blasted by the death of his brother. Claims on the part of the Russian Government for settlement of accounts balanced, absorbed all his brother's estate. He determined to return to America; but Mr. Datterwitz with a M. Shrotzky returned from Orenburg and induced him to accompany them to Persia.

From Astracan, about the beginning of September, they proceeded to Karazan where they were joined by a traveller, M. Martigny, who had been examining the coral island in the volcanic range to the East of the Caspian. In November the party had to take refuge from storms in Kramwood bay, North of Balkan. After much delay and contrary winds they reached Astrabad—there M. Martigny and Datterwitz separated and M. Shrotzky remained with Mr. G.—and they proceeded Eastward with the intention of procuring service in the Punjab, in consequence of reports they had heard from a M. Musaix, (nephew of his former companion.)

This course brought them to Herat where the Journal commences.

Journal.

Jan. 24th.—Mr. Gardiner left Herat with a small caffila of returned pilgrims for Koondooz. Passed by an unfrequented road East of Bamian, through the Hazari country, for sixteen days: the marches about twelve miles—owing to numerous ravines and streams,

some stages were three or four miles only; a very barren region, but heard that to N. W. and towards Killi Nob it was fertile.

Feb. 8*th.*—Reached Khoorzzi, a Kimorz or scattered village, each house separate—in the most convenient place for a farm. Here had to part with ponies, &c. The country of the Kalzubi—who inhabit caves or *Dror* during the winter, and in summer dwellings called Báleej;—they were anciently called Yápats; have dark brown or red beards, live by hunting, and use both cross-bows *(kylash)* and common bow or *kaman*. They shoot their large bow reclining, holding the bow with their feet and pulling the string with both hands.

14*th.*—Most of the party hence went round by Bamian. Proceeded; road very rugged, and much fording through icy water; halted at a grassy place among precipices.

15*th.*—Similar rugged country; halt at a basin of water on top of a black flinty rock, three hundred yards round and of great depth. Caught trout with blood red scales on it, but not allowed to eat them as the place was holy; no visible ruins, but the place was said to have been a city; some rude sculptures and a rock.

16*th.*—Through precipices of Basalt or granite, reach the Dror (in the dark) of Khalyze.

17*th.*—At the Dror—*Khalgubys* are Turkoman conquerors, *Therbas* the aborigines.

18*th.*—Proceeded along bed of a mountain torrent; ascended, but snow too deep in the pass; had to return and go round by a dark narrow pass closed by rocks overhead, called Hersh's dark pass; ascended to a boggy valley full of deep well-shaped chasms.

Ascending over a great spur; saw forest, and a valley said to lead in five days to Hamidan. Halted at a village called Tháugush. Lead and copper found in the neighbourhood; rock limestone resting on granite.

19*th.*—Robbed by our coolies: heavy rain detained the party.

20*th.*—Delayed on account of swollen torrents. Visit a great cave, and on polished floor a colossal figure, eighteen feet long.

There saw grand cataracts under natural bridge.

21*st.*—Proceed—pass a cave in limestone at its junction with granite.

Violent shock of earthquake; earth split, &c.; said to be not common.

Cross a deep chasm by basket and rope, over the Chiganook or Sir-i-Moon, being the source of the Morztab; a perilous passage along a cliff on pegs stuck in the rock.

Naeb Therman Khan's dwelling, Droo. Detained; the direct road ahead impassable by snow—might have retraced path to Chiganook, and thence over hills to Deh Kush, the Ab-i-deb river, and so to Balk.

Strolled to rope-ladder bridge.

23*rd.*—Garden of pomegranate and mulberry.

24*th.*—Visit the Mohcuns and alkaline lake.

25*th.*—Propositions to depart; old traditions.

26*th.*—Leave Droo or Drohoo, due North; deep chasms, pines in (MS. illegible).

Halted here. Hot-water spring at a Therba village; snow on ground.

27*th.*—N. E. N. much snow; bivouac under a crag.

28*th.*—Drizzling and hot; still among snow; great avalanches; grand panoramic view.

Descend; halt at some Therba huts called Nárk, where some altercation with slave-dealers.

March 1*st.*—North: cross Siák river by rope-bridge; deer numerous; halt in ravine.

2*nd.*—Lose way, but reach ruins of Killi Kafir.

3*rd.*—Description of ruins; intricate ravines; pass numerous tunnels; meet first Turkomans; get horses there.

4*th.*—Try to join a Kafila of Nyha traders at Bilkrai.

5*th.*—Therman Khan's son Ibrahim leaves them, arrangements for going on.

6*th.*—Join the caravan at Niok, a watering-station, five days N. E. of Minnoo.

7*th.*—Halted; beds of shells; hears news of his former companion, M. Shrotzky.

[Here occurs a break in the journal, a volume having been lost, giving an account of his visit to Bokhara, and adventures there, including a very dangerous illness.]

June 26*th.*—Leaves Qordook; barren, rugged country to Kolâr; new companion—a pirzada of Mushid, a ventriloquist and saint, flying from Cabul on account of a murder and intrigue, also a Hindu named Jyram, a Therba servant and an Affghan.

27*th.*—Kolâr to Kundûz; numerous pools on almost inaccessible pinnacles of rock.

28*th* and 29*th.*—Detained at Kundûz by Meer Ali Morad Shah.

30*th.*—Set off, and again detained.

July 1*st.*—Very hilly country covered with thorny bush, with grand view of snowy mountains.

Ten miles through fertile valley of Shool, counted 27 pools on the hills within 4 miles; wild ravines.

Fort of Oosrooth; 1000 houses. A road thence by Kroo to Kaffirstan, and by Hindus and Mân.

2*nd.*—Very dangerous road to *Shohaal*, which belongs to Rustam Khan; plundered by one Khan Mohammad; with difficulty avoid going on the reprisal expedition.

3*rd.*—Most rugged country to *Khornúshú*, a very curious fort. Ascent by steep steps on hands and feet to a narrow ledge of rock, —thence by a ladder of skin-rope (or baskets and windlass) to the top, where there is a remarkable fountain; the rock, primitive limestone; the basin about 20 feet wide and 6½ deep in centre, gradually sloping—always bubbling and brilliantly clear; cold in summer and hot in winter, when it hisses with a loud noise like *Noo Shoo;* always full and never overflows; all impurities immediately carried off. Fort very ancient with caverns used now as granaries.

Echo most remarkable from a wall-piece; running up a long valley increasing in loudness, then dying away as it returns, again increasing and again subsiding, three times, the third the loudest.

The hill is described as 180 to 200 yards in circumference at the summit and 250—300 at base, and 2100 feet high.

The tradition is, that when Noah was at Mecca the chief of this land, "Khor" by name, was converted to Islâm and went to pay his respects. Noah now promised to grant him a favour on which Khor bellowed out in a rude voice "Water;" this demand offended Noah, and he cursed the land of Khor which became solid rock; —however to keep his promise he made this everlasting spring at

the top of the hill, and sent his grandson Shur to carry out his orders, calling out Nooh Shooh, which was obeyed, and Echo conveyed the sound to Mecca, and every winter in commemoration thereof, the waters murmur Noah Shooh, and the Echo carries the sound to Mecca, and the place retains the name of all the parties concerned—*Khornúshú*. Blue limestone shows the limits of Khor's land, still held by his descendants, viz. Rustám Khan on the west, and Mohammad Khan on the east.

Mr. G. was, with his companions, let down the whole distance in baskets.

4*th*.—Marches on limestone rock, the barren inheritance of Khor, to Khan Mohammad fort of Trimooke, about 14 miles from base of snowy range; situated at the end of a tabular hill:—several hot springs in the neighbourhood.

5*th*.—Meets party of Bhuri, with Kaffir girls for sale—a continual kidnapping going on in the frontier. There are three main tribes of Kaffirs.

1, of the Koh-i-low,
2, —— Koh-i-káf,
3, —— Koh-i-ghar,

which last are the Siyahposh Kaffirs of Kabul. The former do not shave the head, save a lock for each Musalmán they kill. The latter shave the head—letting a lock grow for every slain enemy. The most valiant may have a good head of hair or a shaved head as the case may be. One of the slaves was of excessive beauty, and was offered for 50 qai or drops of silver, about ½ ounce.

During this march they quit the limestone and get into a granitic and quartzose region—stop at the Ziárat of Abba Shah, at the foot of a cliff of granite 900 feet high. A large (80 yards broad) torrent loses itself in a chasm at the base, and there are several caves cut out of the rock above the chasm, where the torrent disappears with much noise.

6*th*.—Halt at the Ziárat in order to visit four other *Geths* or chasms of similar nature. The fakeers collect herbs, to eat, from the spongy-mossy sides of the rocky dells in which these streams subside. The valley he compares to a great perpendicular cylinder; in the centre of it, a crater-like orifice about 100 yards round; a dark flinty rock.

It is customary to hang certain herbs down this chasm by long ropes for a month, after which, they are considered as panaceas for all diseases. The plant was very bitter, apparently a gentian. It is called Ṭhoceṭh.

The caves are of various size; inside plain: in one he saw numerous images rudely carved of deities and beasts, and apparently letters. The central smooth pillar, 22 feet high, of the main cave was especially so carved.

He sounds the chasm and gets no bottom at 1140 yards!!! and does not visit the other chasm—rich geological sections.

7th.—From *Abba Geth* diverges about 7 miles. Visits a chasm called Groor-geth. Follows a broad impetuous torrent running at the base of an immense (1000 feet) cliff; the valley is ended by a wall of rock under which the stream vanishes, a rocky island dividing it as it disappears, forming a grand water-fall, meeting 20 feet below.

Thence they ascend to the top in a small valley.

8th.—Continued North East course; rugged mountains interpersed with green valleys; next Khoolook, which lies at the foot of the mountains and border of the desert plain called Esh, which runs from Koondooz twenty-five miles to Pralli; twelve thence to Khoolook.

Delivers Morad Begh's letter to Khan Bahadur; meets a Hindu who has a silver-mounted pocket-compass, and part of a map of India —probably belonging to Moorcroft.

9th.—Halt at Khoolook to visit ruins of an old city called Káfir Derra.

It is situated in a narrow pass. The labyrinthine cave cut in marble, grey, white, brown or black, extending about a mile on each side, of excessive intricacy within; prevented from exploring by innumerable venomous snakes—numerous prostrate pillars sculptured with figures; most of the caves mere burrows, 3 feet high. The city is said to have been depopulated by the snakes, which assume the colour of the ground or rocks they inhabit, blue on the blue marble, green among herbage. The pass at the end of the valley is impracticable on account of the snakes.

About 1½ mile due north of Esh, on a bare plain of rock, a colossal

horse in pitchstone, now lying on its side, measure 55 feet from top of the ear to hoof, 42 from chest to tail; legs 14 feet. Two other similar horses, also in ruins, lie on other two sides of Esh, so as to form a right-angled triangle round it.

10*th.*—From Khoolook, E., pass Prâl to the right, cross the desert, kill an antelope and bivouac by a pool in a ravine.

11*th.*—Desert; pass a few pools; robbed by Bhurs of every thing; wolves and leopards and hyenas all night.

12*th.*—March through desert to Oosfung; a charitable chief gave clothes and guides.

13*th.*—Through desert to Coom; great forest to the south towards Prâl in which the Bhurs escaped.

Forest called Erbabfung; wolves in packs of 1000. *Fung* means forest in Káfir. This forest, he says, extends to the borders of Deer and Deord and Pahlooth.

14*th.*—Leave Coom for Budukshán, meet *Obas* of Oosbres; halt at one.

16*th.*—Mud fort Agsa; black mail in shape of guides to Shoolash —a little cultivation.

17*th.*—Flat and level country; passed Shoh, and put up at an Oba.

18*th.*—Over well-peopled country to Budukshán; stopped at a Ziárat in suburbs.

24*th.*—Leave Budukshán. Easterly, well-cultivated, to Shoh.

26*th.*—Reached low hills and ravines. Trap and greenstone;—old ruined fort of Durum under basalt cliffs—report of old caves—marks of old mines, he suspects for topaz, in a stratum of quartz and lithomarge! some limestone with shells; wandering about, looking for jewels apparently.

27*th.*—The basaltic cliffs assume fanciful shapes; supposed to be Káfirs petrified by Abraham. One very remarkable human face on the precipitous sides of a dark ravine of amygdaloid rock is called Babo Boolan, about 25 feet in height, with monstrous red eyes and mouth and aquiline nose:—they are objects of extreme dread to the natives.

28*th.*—Reached this ravine and hills, resorts of wandering Moor, Shoolies and Usbecks.

31*st.*—Reached foot of Altan mountains, stopped at a stone fort,

called Ooz, belonging to a Shooly chief; met 3 Hindus, Suniyassis who had been on a pilgrimage to a volcano in Khirghiz! They had left Hindustan, by Kashmir and Baltistan, through Gilgit, and the Oordoo pass.

About five miles from Ooz is a chasm about 50 feet long, out of which smoke is continually emitted, sometimes white sometimes dark; edges of chasm lined with sulphur and bitumen: can't make out the rock, lava? or basalt? Traces of silver,—gold washed from debris and sand of rock—copper, especially in some of the Geths, where the water is nauseating—galena and tin? (with doubt), also found in some parts.

August 1*st*.—A long march to Shoh, a small fort at bottom of a deep ravine or pass which it commanded—chief's name Mânûssa. Proceeded to see the ruins of the city along a ravine 500 yards, and then through a narrow chasm to a sort of natural gateway, and entered the ancient city. An amphitheatre of rock surrounded a small round verdant vale. The cliffs of immense height almost perpendicular, and crowned with fantastic needle-shaped pinnacles, while the caves were excavated in ledges or tiers above one another. They returned through a natural arch 90 feet high, 25 broad and gradually narrowing to 3 or 4, and ending in a chasm by which they returned —so narrow, that they could scarcely squeeze their way through.

The Shoolies' hospitality consisted in forcing enormous quantities of melted butter on their guests.

2*nd*.—Revisits the city of Shoh in detail; returns by the narrow fissure—an arid way, the Eastern end is ornamented with rude sculptures to about 15 feet high. The cave was about 60 yards long due E. and W.; the Western entrance 40 feet high by 1½ or 2 wide.

In front of the gate is a chiselled platform 6 feet high, 20 square.

This leads to a closed amphitheatre which is described as a mile in diameter, the bounding rocks 1500 feet high, and the mountains encircling them 3 or 4000, having a chasm of 3 or 4 miles.

The centre is a green mossy oval of about 300 yards broad, surrounded by excavations,—circular or square caves,—outside of which are peristyles, arcades and columns in eighteen different ranges;—the columns very irregular, varying from fifteen to eighty feet in height. From the lofty mountains, fell innumerable cascades down into

deep ravines which wound away to the east, and formed a tributary to the Oxus: none fell actually into the amphitheatre itself. There were but few images carved on the pillars, all very rude in form, some obscene, but highly polished, the smaller hieroglyphics, resembling those at Abba Geth, were neatly finished.

But the most surprising part of the narration is the acoustic effects of the wind and water-falls producing musical notes, which give different effects, louder or softer, according to the situation of the stander, at the base resembling an Æolian harp, in the middle tiers an organ, while in the higher places, military music.

3*rd.*—Proceeds towards Derra Derwas through rugged mountains, stops at caves occupied by two devotees, who worship the sun and certain idols. The principal of whom they styled Akoo or Hakoo (which may have some connection with Akâ Carbghar) the other "Shoob," (query Shiva?) whom they consider the titulary deity of the Shooly tribe.

4*th.*—Through rugged mountains to the fort of Droo at the south entrance of the Derra; here crossed the stream found by the Shooh cascades.

5*th.*—Left Droo and enter the pass. The Oxus here pretty considerable; most of the tributaries from the westward; the pass to Tundrel westerly to the post of Cheela.

A considerable post on the side of the mountain;—north of the pass and on the western side of the mountain, at the foot of the fort, a village of 7-8000 inhabitants, partly Moghul partly Shooly. The chief, a very obliging Moghul. To the east of the village a narrow culturable valley lay N. and S. About a mile off the sources of the Oxus. A long series of spongy ground lies at the base of basaltic mountains, and the springs collecting into one body flow out to the S. then E. for 1½ days march, entered then E. S. E. into the Derra Derwas, 30 miles beyond Cheela, and then westerly to Turkistan.

Distribution of the Kafir tribes.

Great Kafirs Koh i Ghâr,	80,000	Generally called the Kafirs.	In Turkistan proper.
Kâf,	50,000		
Loo,	25,000		
Kafirs of Esh,	15,000		
——— Oohshah,	12,000		
Khâl Krooh,	12,000	Not Mahommedans, but not included in common parlance among *the Kafirs*.	
Gob or Gabr,	12,000		
Ghâr or Gharri,	12,000		
Lâh or Lâshi,	12,000		
Oodoo,	12,000		
Phalooth or Phah,	12,000		
Shooli or Shoh,	15,000		
Khoorook or Kroo,	12,200		
Therba or Thur,	12,000		
Bhur,	25,000	Half Mahommedan with some heathen practices.	
Mâr,	40,000		
Akaa or Cushyhar,	250,000		
Boo or Boolee,	12,000	On borders of Turkistan, Hindus or Budhists.	
Kahooz or Hoohee,	12,000		
Phah or Phagi,	12,000		
Aspah,	12,000		
Koolees,	12,000		
Mookloo,	12,000		
Maha,	12,000		
Kalesh, Lesh, Malesh,	12,000		
Beh or Behel,	12,000	Chinese subjects.	
Plahi or Plaaghii,	12,000		
Bhoti,	12,000		

The language has no resemblance to Persian or Arabic, but has some to Sanscrit?

The Akaa tribes bear nominal allegiance to Yarkund, the rest seem quite independant—some trace of Geber or fire-worship exists among them.

[Here another hiatus occurs in the Journal.]

27*th.*—Reached the Oostam pass, whence rises the Jeljow river, which runs W. to Ulook where it joins the Karoo from E. N. E. (from Poofean in the Aktagh), thence W. to Rorlaar where it meets the Koorkor from S. E. (rising in the Karatagh), thence W. (and takes the name of Zarafshân or Samarkand River) to Faalghâr, thence by Dhomzul where it is joined by the Lohthoo (which rises at Neo

Abool in the Konijuk Mountains, two stages E. of Durbend) from Domzul W. by Keemo and Paban, to Koor where it is joined by the Kom (which rises in N. E. out of a lake of Kom in the valley of Yar Ailak at S. base of the Yar Tagh) ; from Kom by Ormaz where the Oor meets it from the south, rising in the Kânuth M. ; it is subsequently joined by the Sanch or Pungkund at Tanoor from the S. by the Joonoojup at Oosk, from the lake of same name, 1½ day from E. of Oranthopa, a large place on south side of the Aktagh ; being joined at Zoon by the Noodoorth, which rises in Lake Maz, two days east of Karatess, and passes by Dizukooch.

From Dook the Zurafshan runs W. to Samarkand, about 250 miles from Oosk.

To the S. of the pass, a day's journey, under the peak of Nouont Kaw rise the Soorkhab or red river, (also called Kafirnoohan,) and Hazár *H*oon, two main branches of the Oxus.

The Kafirnoohan runs S. W. to Zinoo ; thence to Taux, where it is joined by the Molpooth (rising in mountains of same name) ; S. to Sheroog, where it meets the Zerâb, which runs N. E. in the Molpooth mountains ; passing Shadmar, joins the Amoo at Tahoothen. The Soorkhab rises N. E. of Nornuth Kan, runs by Madpooth joined by Aubkoor from Lake Khiangkul, thence S. and W. to Shunwar, where it joins the Oosh from E. (from Lake Kara Kul,) thence S. to Khâratagoon, S. W. to Cessopek, where it meets the Numa, rising at Taux to N. W., thence S. by Rahamoot, Boolgwan, Yargaan, Doppa, where it meets the Darri Druwas, or Bolor branch, thence S. W. to Chukti and Khojahar, where it meets the Kant Tagh or Budukshan and is first called the Amu.

The fort of Oostam is said to have been built by a son of Timur, named Rustum ;—half the inhabitants Mahommedan Moghuls, the rest Akaas.

The foundations of the fort are of Cyclopean architecture ; squared blocks 24 feet long.

28*th.*—Entered the pass—bottom of deep ravines, continually wading. Halted at springs.

29*th.*—Proceeded through deep ravines, but less wading.

30*th.*—Met three Akaas going to Ausgess—large flocks of wild goats. Akaas brought five down with arrows. They had several bows ;

the Therba had a larger one. Kills a large eagle, said to be migrating—dark brown with triangular spots of grey and white; legs clothed to the toes; tail black tipped. Reach Ausgess, a small fortress near the ruins of a considerable one; only inhabited by Akaas; fed with butter by the chief.

Met three Moghul merchants, who join their party; intend stopping at Oossoobuk for a caravan.

31*st.*—Proceed E. and N E.; reach Oorcombuk, a large well built fort on brink of a precipice to E., at E. end of the Oostum pass, twenty days S. W. of Cashgar; joined by seven more Yarkund merchants—the caravan had preceded them.

The Akaas are short, stout and hardy, but few Mahommedans, except the tribe Oojuem near Andijan—women not handsome—dress, skins. The Keiaz tribe live in caves on the highest peaks; subsist by hunting; keep no flocks; said to be anthropophagous; but have handsome women; eat their flesh raw.

The Keiaz marriage rites are simple, the lover lays his bow at the feet of the lady; if she lifts it up, kisses and returns it, she is his wedded wife. By taking the husband's bow and flinging it on the ground before him, she might divorce herself, and she might secure a husband by unslinging his bow from his shoulder. The husbands have the power of selling their wives. They peculiarly venerate Hindu wanderers, giving up wives and daughters to them; if any progeny result, it is considered as a Demigod.

Two days N. W. of Oorcombuk is a sacred spot of perpetual fire issuing from a rock. The Aktagh Range, as shown in the Oostum pass, consists of gneiss, mica, slate, clay-slates and limestone, with some exception of traps and basalts; specimen of mica half yard square. Gold plentiful in the streams, both washed from the sand, and caught in sheep's fleeces.

Sept. 1*st.*—Leave Oorcombuk for Yarkund, with *musuks*, i. e. water-bags, tied to horse's belly; E. S. E. to Doonchoo three days. Little water and a few ruins for the first few miles; enter desert, bivouak in a dry ravine.

2*nd.*—Some pools in a deep spongy ravine, brackish; numerous flocks of antelope and some wild yaks called *Ausuk* by the Akaas; three different species thereof.

3*rd.*—Continue over arid desert intersected by ravines, reach and ford the Yaman Yar, and reach Doonchoo fort on its S. bank inhabited by the Choo tribe.

4*th.*—Stops at an Oba of Choos.

5*th* and 6*th.*—Had again to carry water.

7*th.*—Reach Châu, a large village on the River Châu, which rises in the Bolor mountains, ten days S. W.

8*th.*—Halt at an Oba on the bank of Lake Doon 1½ by 2½ miles; its water is rather brackish, but better than that of the springs; five marches north is a large lake—Doon Hoog, *Doon* meaning lake and *Hoog* large; *hee* means little; numerous other lakes large and small.

9*th.*—At Doonhee, an Oba of Choos 600 yards by 100, water sweet;—large flocks of geese, &c.

10*th.*—Over undulating desert to fort of Keshing, near a low range of secondary limestone;—five days W. said to be mines of lead in the Khia fiery hills, and two days further copper at Oostom.

11*th.*—Through desert, but water plentiful; through low limestone rocks, the chains N. S.; road E. W., none higher than 100 feet; halt at a good well;—attacked by 100 robbers; rocks alternate clay-slate and sandstone, occasionally gneiss appeared, also black slate and conglomerate.

12*th.*—Proceeded S. E.;—by midday got clear of the ranges; road rocky.

Khoolbrân on the Pohush river said to rise 20 days S. W. at Pooshtee.

Near this is a poisonous well,—not coppery,—unctuous to feel, nauseous to taste, deposits white fine silky threads on knife blade; mercury?

13*th.*—Stop at an Oba—desolate rocky region.

14*th.*—Through ravines, in an extensive plain.

15*th.*—Meet caravan from Yarkund, 100 camels, 50 Tatar soldiers; tea, cloths and silver to Samarkand.

16*th.*—Bare rocky desert intersected with ravine.

17*th.*—Ditto reached Mahoo Shung on the banks of the Pohush, built of massive stone, occupied by Kebee tribe of Tatars. Water unwholesome, save a few wells, though it looks and tastes good; people look *green*. Near it the overwhelmed city of Mahoo.

18*th.*—Halt and visit Mahoo in detail. It is a great tumulus, about 300 feet high and 2 miles round, honey-combs in every direction with chasms and caverns, which are all more or less deleterious from mephitic vapour, encrusted with corrosive salts, grey, yellow and green; no reptiles or bats in the caves. A deep gully allows an approach to the centre nearly, and discloses cut-stone, earthenware and other marks of inhabitants: at the vernal equinox, numbers of Akaas collect, and enter the caves in search of reliques; images large and small and broken, of which he saw seven, some jasper, some of pottery, all pierced, and numerous fragments of vitrified idols; the pilgrims are said occasionally to find large ones; they often perish from the mephitic vapour. The whole ground is a mass of extreme confusion, the upper portion of granite rocks, heaped as it were on the ancient city.

The tradition is that Ma and Hoo, twin brothers, both in descent from Toth, emperor of the east, ruled for some time. Ma was a righteous prince. Hoo murdered him by burying him alive. The prayers of the dying Ma, caused Hoo to be buried alive, and with him all his fellow citizens, the mountain tumbling down upon them.

19*th.*—Left Mahoosung, through hills; reached Meeshaw. Here the route by Dera Drewas meets this. Beyond this, extensive plains stretch E. and S., which to the N. the distant range of Kalook bounds N. E. and joins the Kebee or Ashan ranges.

20*th.*—E. S. E., cross immense plains to Shooshee, a small village; meets the first Kebee revenue office.

21*st*, 22*nd*, 23*rd.*—Extensive plains occupied by the Kahall tribes.

24*th.*—Reached Yarkund. It consists of two cities, one inhabited by the Mahommedan Moghul population, the other by the Chinese or Ketai garrison; gates close at night; 80 to 100,000 souls, 15000 soldiers. There is a Moghul governor (at the time Khan Ali Jan)—the Chinese Governor was Shun Teth.

Tea, green and black, packed in vellum, shawl wool from Chungtang, Porcelain, and Chrysoprase beads are the principal articles.

27*th.*—Left Yarkund along the Kroo river to Phoom.

28*th.*—Khoorgaleek.

29*th.*—Below or eastern branch of Kroo.

October 1*st.*—Jaunshun a small pond of bad water.

2*nd.*—Crossed Kroo to Thoongur.

3*rd.*—Re-crossed river Mahazar; river ankle deep.

4*th.*—Panpoon, source of Kroo in Yagnee Dewas range.

5*th.*—Khandook, centre of range at some small springs in ravine.

6*th.*—Site of old ruins; on a plain, low stunted trees.

7*th.*—Khoolam on N. bank of Yarkund River; met a caravan of 200.

8*th.*—Crossed river; thick jungle to Oomah.

9*th.*—S. E. to banks of Khoolkan River; thick low jungle.

10*th.*—Halted on banks of river.

11*th.*—Reached ruins of Khoolkan at the northern base of the Karakorum.

12*th.*—To S. E. through the range to an Oba of Changtung Tartars, three days west of Sernihee.

13*th.*—Through a rocky wilderness E., along range of hills.

14*th.*—Springs; source of the Koo-le-loo, which joins the Indus near Iskardo.

15*th.*—Crossed the stream S. E.; large springs, source of the R. Cherera (the stream rises at a lake called Koofaloo) which runs through Nobra and joins the Indus at Nahoon, 5 days S. of Ladak.

16*th.*—Crossed rocky well-wooded chains.

17*th.*—Ditto ditto.

18*th.*—Due E., west bank of Shaighuk, opposite Tupchan.

19*th.*—To Khamdavu.

20*th.*—S. E. (to avoid crossing the Shaighuk and Ko tak lek) to Dovin—low marshy ground, five miles from river—opposite to Gartop.

21*st.*—Along banks of river to Bolung Belook.

22*nd.*—Ditto to where the Doorgh meets it on opposite side.

23*rd.*—Ditto to Fitkar.

24*th.*—Ditto to Lohoo.

25*th.*—Ditto to Tooknoh, three miles from Akkan.

26*th.*—Crossed the river; to Meloor, 5 miles S of Dooghan.

27*th.*—S. to Chehe.

28*th.*—Arrived at Ladak.

30*th.*—Leave Ladak for Cashmeer; first march to Tunguh. Boojjoo—lead-mines said to be.

31*st.*—To Shohung.

November 1*st.*—Kulsee on north bank of Indus.

2*nd.*—Crossed to Lemeeroo by a rope bridge—a sangar, two miles lower;—about two miles east of village are ruins of a large city called Lormun.

3*rd.*—Koosun.

4*th.*—Kurjull of Peshmul.

7*th.*—Drass near Kishengunge, at base of snowy range.

8*th.*—Left main road to west to take the horses by larger round; kept at huts 500 ft. below snow.

9*th.*—Halted in snow.

10*th.*—Reached Gughunghir; reached Cashmeer on 13th, just in time to escape being snowed out.

16*th.*—Leave Cashmeer, with the Therba, Syed Mir Ali Shah and Jyekam, with two Cashmeer servants, a party of six intending to go by Khaján. Gilgit and Cashgaar road to Cabul, and thence to Pakrood.

17*th.*—To Baramoola.

18*th*, 19*th.*—Halted two days to sell their horses.

20*th.*—North, to a small village Sehul, at foot of Kukka Brumba mountains; people converted in Aurangzeb's time from Hinduism;—the Kuthrees called Kukka and Brahmans Brumba, hence the name.

21*st.*—N. W. from Kukka Brumba to Choob 22 cos from Baramoola.

22*nd.*—Cross range; halt at huts below snow.

23*rd.*—N. descended to Ameer ke Ghurry.

24*th.*—Deep ravines; crossed Kishengunge at Bukoo; halted at Haji Ghurry.

25*th.*—Dark ravines, then green valley, N. W. Aspeloo Fort of Moorook at head of valley, belonging to Shah Newaz,—very fanatic Mahommedans,—Syuds are every thing;—the *Bolunus* and *Gujars* frequent the mosques all day. Khajum extends to Peeloo and Soogoor on Indus;—butter, a man's load for rupee!

26*th.*—Road through bed of torrent; water very little in morning, increase during day from melting snow;—ascended to foot of snow to Beer.

27*th.*—Pass Poolaik; steep ascent to Shah Husun la Ghur; Meloo Shah, the owner, advises them to keep North of Gilgit to go to Chitral; the Chitral river or Akoo rises in a large lake 6-7 days E. from Bolor or the Peloa Mountain, while on the direct road over

Ashoo Hamoo road from Gilgit; there are six or seven marches through snow in summer.

28*th.*—Reach Peeloon on Indus; get rid of their Ghonts.

29*th.*—Frightful march overhanging the Indus, along ledges, &c.; hauled across in a leather bag, nearly opposite the junction of Gilgit River, to Shooghoor. The range is called Ashoo Hamoo to the *Ushur Kafirgulli* pass at sources of the Abba Sind; thence westward the Deer or Durd Mountain. Bramhu and source of river Lunda which it seems is the *Cabul*, of the Bonur of the Abba Sind.

30*th.*—Cross Gilgit river by rope-bridge, and up its West bank; dreadful path along precipices to Ashnoo. Here in a mosque! in an inner room is an idol, much reverenced, resembling Neptune with a trident and Greek helmet, black sable, called Konchoo; said to have been found in a hot spring. Near Ashnoo, (old name Oor or Oornath) were extensive ruins of a large city and cave on table-top of a large mountain; a large pond in the middle; remains of old Fort. Greek coins plenty, two of King Maius;—petrifactions abundant; they are laid by the image, and then, becoming holy, are panaceas.

The Moolla said they did not worship the image, but respected it as that of the founder of their race, Shoohungrow, grandson either of Solomon or Noah!

The Iskardo people are descended from Askar, son of Alexander by Nargat daughter of Phalgon Raj.

By Oospun daughter of Mamkoosh of Gilgit and Deer, Alexander had two sons Usperan who died, and Ful who was taken away with his mother by Alexander, and became king of Gershon far off in the sea near Mecca;—and by Maihethata daughter of Bambur of Bolor, a Sholee, he had one daughter Lahama who married the son of the Gilgit king.

31*st.*—Left Aushnoor, very difficult road along W. bank of river; entered valley of Gilgit, 10—15 miles broad to Dairshen where it expands, about 80 or 100 miles long, on W. Gil Hamû mountains, which to S. join the Ashoo Hamoo; they have no pass and are covered with perpetual snow.

To S. of this great range is Yusufzahy, between great and little range; Kafirs dwell in valley of Kahinook; the little range or Kahinook joins the Gilgit near Aushman—Kafirs low, red, broad; blue eyes.

Halted at a ruined fort at Morokagnl; village and fort of Tahi at junction of Peloo or Hanzi river with Gilgit, which rises at Khankoon and passes fort Goolzar; Gilgit town and fort a day's march on E. bank of river.

Prejudice against married women milking; the animal is killed and eaten, else it is thought too divine.

Estimates population at 25 or 30,000 of all Gilgit; revenue 1-10th of produce.

April 1*st.*—Passed 3 or 4 good villages and forts. Halt at Pok Zoleen belonging to a semi-independant chief, Shah Hosyn; a good day's march, S. W. from Gilgit.

2*nd.*—Well cultivated; halt at Stambook, a fort; opposite to Jaâkoor on E. bank, and two miles lower—on E. bank, Booloo. N. E. of B. are hot and salt springs.

3*rd.*—Hugged the base of mountains—much jungle grass—halted at Plunghaee Pelongue? valley about 12 miles round. On bank of Peloo, which rises at Kafirkál to S. W. and joins the Gilgit at Mishnik, a fort belonging to Ruvanshun.

To W. of Pelongue is a pond and well, whence rises the Akoo, and runs through great range N. W. and W. to Booshperkai, two days from Duirshen.

4*th.*—Crossed Peloo by raw-hide bridge; rugged country; halted at a ruined fort, Zanzé, on bank of Shangrâf, which is 15 yards wide and was crossed by a hide bridge. Hence a pass leads to Chitrál; Galena found.

5*th.*—N. W. bare, uninhabited country to Shemâl on the Akoo, belonging to chief of Dharm-Dairahim; on opposite side a large river joins, which has two branches from Peloo and Bolor ranges.

Then through Akoos from the Chitrál river—cold—ice 6 inches.

6*th.*—Over rocks and chasms down the Chitrál by the *Shoor* pass to ruins of Káfirwan, fort Cyclopean; narrow valley, rock of immense height; 200 yards lower down a 3rd branch called Thook joins the Akáhoo—Kai e Mâl e Kanki—Chitrál mountains granite, mixed with a black rock of glassy fracture.

7*th.*—Along precipitous sides of the den 30 yards; sometimes even with ropes to help; find two murdered bodies on the road!

Reach post of Booskerkan belonging to a Moorzoom chief Mahom-

medan, half savage, named Joonjuk, dependant on Aunwah. The post is on top of a precipice, but under precipitous mountains all round, so that the sun never shines there.

Avalanches from opposite snowy peaks—portions leap the river.

8*th*.—Halt—the proper name of Káfirs is Ziak Kaioon; story of two Europeans who were imprisoned and died 60 years ago.

The Moorzooms still worship sun and moon, and respect idols. The Koo or Khookraw—(dirty Khoo,) is a wandering thieving tribe —worship goats and silver, wear their skins in dress, or any black colour, but red ibex or white never. They eat their meat raw. They eat the heart and liver of their own dead.

The Káfirs generally either bury their dead erect in snow, or expose them on some bare precipice, first extracting the heart and liver, which are burned on an altar, then kept; or occasionally as a sign of affection, the ashes are mixed with herbs and eaten.

Here procures a man of medical character, Shaubul Ali, and with a son of Tunguth Shah determines to endeavour to penetrate into the Kaionook (Káfir) country.

9*th*.—Sets off with Mokl, nephew of Shaubul, Tunguth's son and two other Moorzooms, Joy Ram and the Therbah, the Syud, &c. agreeing to wait at Anony for their return.

Rugged rocks and snow, up and down to ravine with a torrent of melted snow to Khoest, the remains of an old fort and some caves in side of a precipice of immense height, with remains of ruins at the top.

The only residents are Moorzoom fakeers turned Zai. The Zai would not touch the Cashmeer and Kabul Mahommedans, but had no objection to the Hindu and Káfir. *Mamoo* they call Mahommed, and consider him a priest of the Zai order. Zai is the hero-founder of the Khaioo tribe and son of Ool, the god of fire; as an idol he is worshipped as a human head surrounded by fire. That at Zai was cut out of granite, five feet square, in a deep recess, which he was not allowed to approach nearer than ten yards, a line of blood and ochre marking the holy boundary. It was situated at the end of a rocky platform, surrounded by lakes, to reach which they first descended the ravine and then ascended a smaller crevice some 30 or 40 yards long.

Story of two Europeans killed as evil spirits.

10*th*.—Sends all his papers and goods on with the Syud to wait at Peshank, and proceeds simply armed and in goat-skin dress; rambles about Khoest, while a son of Shaubul got permission for him to proceed.

At the meeting of the Khoest torrent with the Khaima river is a bituminous spring forming a black slimy bed 36 yards long, 5 feet thick, at the foot of a precipitous rocky ridge—beneath it a thin stratum of greenish sulphureous matter, then another black bed, looking like metallic scori: two miles from this are emetic springs, used by the natives, which contain copper. The mountains are here composed of granite, on which rests mica slate or clay slate, with occasional masses of lime-stone and sandstone with fossil shells.

Large mountain-deer numerous, also a smaller spotted deer, ibex, goats, &c. &c. &c.; two sorts of musk; the drug is only used for magic, not collected, and the flesh not eaten.

Tradition of the Oosthoo pigmy tribe, now represented by the Khoo and a few wanderers in the most inaccessible recesses, who use slings with great skill.

(Tale of Alexander's conquest of Peshawur is here inserted, (Gandur, the Eusufzahy country), and how the remnants of his army and the Gandurites were repulsed by the Hindus; forced to shelter in the higher ranges and thus founded the Káfir race.)

Snow heavy.

21*st*.—The Rahk, or disciple returns with an invitation to visit Sheheh Thaiu, with two Oorgs or priests to show the way; hands and feet again examined if broke.

22*d*.—Ascended the stream to North, on West bank about five miles to cross by a log thrown across the top of a frightful chasm; most difficult path rendered worse by snow and ice; to summit of ridge 2000 yards. Continued Southerly on E. bank of river; rested for night in a cave opposite Khoest. Their food was toasted *Sall*, (seed of an herb) and Kheira or Khee? with Laiss (wild garlic).

23*rd*.—S. and S. E. rocky bare region; granite and limestone to a

natural reservoir in limestone, called Loong, a short day's march N. N. W. from Thesprâk where there is a village of Khoioos—holy shrine and springs, caves and two idols called *Keoo* and *Beth*.

24*th*.—E. and by S. at first very barren and rugged—then through vales with alpine flowers; meet hunters of Khioo tribe, at Prâ; ruins of a round tower; a cave commences here, said to lead to Thesprâk.

Hunters had an ibex, a chamois, and a *quee*, a small goat, the size of a cat. They were dressed in chamois skins, hair outside, and bear skin caps; head shaved (the Oorgs had long hair).

25*th*.—Along a deep ravine N. E. to foot of snowy range, then S. and S. E.; crossed numerous currents over logs; very barren; two hours before sunset reached base of Shehelkhale; ascent very steep; loose stones and rocks, nearly to snow line; passed sunset when they reached the caves.

Dinner of half roast goat, and uncooked preserved bear's meat, with oongzoo, a sort of tart, wine to drink.

26*th*.—Before breakfast, looked about innumerable scattered caves; very small entrances, dug in gravelly bank of mountain; 2000 feet below is a wooded ravine, the orchard and vineyard of the place, which has about 900 inhabitants. The Shoosher river empties into Khaiemah two stages below Chitrâl.

27*th*.—Description of the women, dress, &c. &c. At noon proceed to the shrine; descended 1½ hour to vineyard and fruit trees.

An earthquake, which forced them to halt in caves, where an old man of 150, lived with 5 generations of descendants, his sons, white beards, of 80.

28*th*.—Reached the shrine in ¼ of a day; caves in face of a very high cliff; narrow and difficult path, and steep ascent to platform and cave where the Oorgs live; thence ascended again to a platform, 15 yards by 2; entered cave 4½ or 5 feet high, 3 broad, widened to 15 feet; after 80 yards hightened to 25 feet, a fissure, 2 ft. wide; entered through it into a large cavity 36 yards round and 50 high; on N. side of it two figures cut out of the *Shehel;* that on the right Sheh, on left Heh (or Zahel); by a less difficult path over the rock and to a ravine to the saline springs, which are both cathartic and emetic.

29*th*.—Returned to the old man, and halted some days for guides till 5th May, strolling about many deserted caves, and a large cave with idols—the original shrine deserted, because injured by earthquakes.

[Here the Journal ceases, the next volume describing the journey through Kafiristan, was lent to Sir A. Burnes and lost.]

PROCEEDINGS

OF THE

ASIATIC SOCIETY OF BENGAL,

For April, 1853.

At a meeting of the Society held on the 6th instant at the usual hour and place,

Sir James Colvile, Kt., President, in the Chair.

The minutes of the last month's Proceedings were read and confirmed.

Donations were received—

1. From Dr. Campbell, Darjeeling. Two skins of the yellow Fox of Thibet, one young and the other a mature specimen.

2. From Dr. Fayrer, Rangoon, a large gilt Figure of Guadama.

3. From W. G. Young, Esq. Under Secretary to the Government of Bengal. A map of the district of Monghyr, for the Museum of Economic Geology.

4. From Lieut. E. T. P. Fergusson, Superintendent of the Government Observatory at Bombay. A copy of the Magnetical and Meteorological Observations made at Bombay, in 1849.

5. From Captain Thuillier, Deputy Surveyor General. A map of the Monghyr district surveyed by Captain Sherwill.

Ditto of the Northern face of the Vindhya Hills surveyed by Captain Sherwill.

6. From Captain Pearse, Hazara. Four small copper-plates inscribed with Bactro-Pali characters, excavated from a small mound in the village of Shâh Dhairee, on the high road from Rawal Pindee to Hazara.

7. From Professor Fleischer, Berlin, part 3rd of the 6th volume of the Journal of the German Oriental Society.

8. From E. Thomas, Esq., twenty-seven silver coins presented on the part of the Government by E. A. Reade, Esq. Commissioner, Benares.

A sketch of the spot on which the annual fair in Sagar Islands is held, lent to the Secretary by Mr. E. A. Samuells, was laid on the table.

The following gentlemen duly proposed and seconded at the last meeting were balloted for, and elected ordinary members—

Babu Rádhánáth Sikdár,
Dr. Macrae, and
J. E. Medlicott, Esq.

Pursuant to the recommendation of the Council, read at the last meeting,

Lieut.-Col. C. H. Rawlinson was balloted for, and elected an honorary member.

The following gentlemen were named for ballot at the next meeting.

Sháh Kabír Uddeen of Sasseram, proposed by Ensign Lees, and seconded by Mr. B. J. Colvin.

Mr. C. W. Cunliffe, proposed by Mr. Grote, and seconded by the President.

Mr. D. Grant, proposed by the President, and seconded by Mr. Grote.

The Council submitted a report, recommending the following changes in the mode of publishing the Bibliotheca Indica.

1. The discontinuance of a paid editorial staff, and the institution of a scale of payment for editorial labour at a maximum rate of 12 Rs. per sheet of 8 pages; the work to be brought out as at present under the superintendence of the Philological sub-Committee.

2. The publication of each work of the series in such form as to admit of its being separately purchased, whether in text or translation, and the reduction of prices to such sum as shall made good the cost of printing, plus one-fourth that of editing.

3. The discontinuance of the present practice of insisting on translations from the editors of texts.

The recommendations, being put to the meeting seriatim, were unanimously approved.

Communications were received—

1. From Rev. J. Garrett of Bangalore, enclosing lists of Canarese works published in Bangalore.

2. From Rájah Ishri Prasád Bahadur of Benares, forwarding a Catalogue of Hindi and Urdú books contained in his library.

3. From W. Muir, Esq., Secretary to the Government of the N. W. Provinces, forwarding Meteorological Register kept at the Secretariat Office, Agra, for the month of February last.

4. From E. C. Bayley, Esq., enclosing a short and imperfect inscription from Pinjore given to him by Mr. L. Bowring of the Civil Service, and for deciphering which, he has not the necessary references at hand. Mr. B. sends also a copy of the Khunniarah inscription, on the subject of which he observes:—

"I send you also the Khunniarah inscription, or at least a native copy of it; I am sorry it is so disappointing; there are two stones, on one of which is the upper on the other the lower line. The actual letters are said to be four or five inches high, so that this is a mere copy taken by hand. I will endeavour to go myself and get an impression, if you think it worth while. Having once set about this work, I find several inscriptions exist, of which I am getting copies. There is one in the great temple at Kangra, but the copy brought me, was too carelessly made to be worth sending. I have read it however in part, and find it gives three names in the Bansavalis, Megh Chand, Dhurm Chand and Sansar Chand. Of the former I have coins. The date of the inscription, I unfortunately cannot read in the copy, but it must be about 1500 to 1510 Sambat. There are other inscriptions in the fort, one of which is clearly dated 1434 Sambat Vikrama Deba; but unluckly it is so defaced that I have not succeeded in getting any thing else out of it, yet this is also the case with a short one, bearing date 1260 Sambat, but I am still trying to see if I may not get it made more legible by care. Of coins also, I have got another, king Apurwa Chand, and two others still undeciphered; but I dare say, I shall shortly get other specimens to work out these, and give me one or two names."

5. From Captain Cunningham, explaining the cause of the delay

in bringing out his paper on Kangra and other coins, for which plates have been for some years in the Secretaries' hands. Captain C. hopes to be able to send it soon after reaching Mooltan, as well as an account of the Buddhist cave of Dhumnar, which he has recently visited. After enumerating fourteen Kangra kings whose coins he has deciphered, Captain C. concludes thus:—

"The delay that has taken place in the publication of the plates of the ancient coinage of India, is a source of much regret to me, on account of the interesting light which they throw upon the history of India. It is generally known that all the oldest coins and inscriptions now existing in India, are of princes of the Buddhist faith, but, I believe, that few suspect the existence of ancient coins of Brahmanical princes. Such however have been lying in Calcutta amongst my engraved plates ever since 1848. The undoubted coins of Brahmanical princes are those of a *Brahma Mitra*, *Vishnu Mitra*, *Indra Mitra*, *Agni Mitra*, all of whom are Vedic deities. Their antiquity, though not so great as that of the Buddhist coins, is nevertheless earlier than the worship of Siva and his Lingum, as is proved by the significant want of any coins of Mahádeva Mitra, Siva or Iswara Mitra. The alphabetic characters, which are similar to those of the inscription on the Sanchi gateways and in the Buddhist caves of Western India, range these Brahmanical coins about the beginning of the Christian era.

"I have written thus far for publication in the *Proceedings* of the Asiatic Society, if you will kindly insert it for me. I have many papers in view for the Society's Journal, but I can do nothing until I reach Mooltan, I am anxious to have all my plates of Hindu coins, which are now with Laidlay, engraved as soon as possible, and I will then send the letter-press for their illustration. The work will form a complete collection of the ancient coinage of India."

6. From Dr. Bedford, Rámpur Bauleah, enclosing a paper entitled "Contributions to the Statistics of Bengal,—Income, Expenditure and Food."

7. From W. G. Young, Esq., Under-Secretary to the Government of Bengal, forwarding a copy of a letter from the Secretary to the Board of Revenue with its enclosures, respecting certain specimens of gold from the Jugloo River in Assam.

The Secretary exhibited to the meeting the first sheet of a Sanskrita Lexicon, by Professor Bohtlingk, now printing at St. Petersburgh.

The Curator of the Museum of Economic Geology and the Librarian submitted reports of additions made to their respective departments during the last month.

Read and confirmed, 2nd May, 1853.

(Signed) J. W. Colvile.

Report of the Curator Museum of Economic Geology for the month of April, 1853.

Geology and Mineralogy.—Dr. Cantor has presented us with a specimen of Fossiliferous limestone from Girbee in the Straits of Malacca of which the following is his memorandum.

1. Fossiliferous limestone and lignite from Girbee. The late Captain Congalton, H. C. Steamer *Diana* proceeded in July, 1845 to Girbee river, on the Malayan Peninsula in 8° 0′ N. L. On his return to Pinang he communicated to me a diagram and memorandum of the locality in which the lignite occurs.

Támah is a hillock about 11 ft. high above the strata.

Length of the strata from 300 to 400 ft. their diameter from 1 to 14 inches, those of the greatest diameter below the seam of lignite, and they deviate from the upper strata at an angle of 4 to 5°. In the ironstone nearest Datoo Putri appears a cave, nearly circular, about 20 ft. in diameter, but of no great depth. Round the cave radiate short strata, 4 to 5 ft. in length, of fossiliferous limestone like the strata below Támah, Tanjong Datoo Putri is a limestone rock, not stratified, about 500 ft. above low water mark, and about a mile distant from the hillock Támah.

The seam of lignite runs nearly horizontally from east to west. The eastern extremity is 2 inches in depth, the western 8 inches. The shells of the strata appear to belong to the genera Paludina and Melania, and closely resemble recent species inhabiting the Malayan Peninsula and Islands.

Economic Geology.—The following report relates to the specimen of copper ore from the Barragunda mines in the Hazareebagh district, now on the table, which was examined at the request of Mr. Mackenzie. This gentleman informs me that the mine has anciently been worked to a very great extent under the native governments, but that they only worked one

side of the lode, which no doubt was of a kind of ore which they found easier to smelt, or less mixed with silex than this which they have left.

Examination of a Sulphuret of Copper from the Barragunda Copper Mine, sent by Mr. Mackenzie.

This ore is imbedded in a clear quartz matrix, and, unless the dressing be very carefully attended to, a heavy loss will always arise, either from the quantity of ore rejected in small fragments by the dressers on the one hand, or by the quantity of silex which will find its way into the furnace as ore on the other. At least 10 per cent. should on this account be struck off from my actual results, which were of course from a lot of picked fragments of pure ore, as free as possible from matrix. There is also a considerable mixture of iron pyrites with it, which will in practice deteriorate much from its value, for the two are constantly mixed in the dressing.

I find that this ore contains in 100 parts as follows:

Silex,	0.50
Sulphur,	31.42
Iron (Perox. 48.55) Metallic,	33.98
Copper Metallic,	34.10
	100.00

The iron and copper being both in the state of bisulphurets.

In the smelting of this ore on the large scale it must be taken into account that the 34 per cent. of copper will be reduced in practice as follows:

Silex with the ore, from veins and bad dressing,	10 per cent.
Sulphuret of iron mixed with it at least,	10 „
Waste in smelting at least 10 to	15 „
	35 per cent.

or say one-third; so that the 34 parts of copper will be reduced to 34 less 11 or 23 per cent. of the ore as sent to the furnace: and if this is obtained, it will be by very good management.

H. Piddington,
Cur. Mus. Econ. Geology.

March 11th, 1853.

I have next to announce a discovery which may be of importance, being that of a fine variety of coal in the neighbourhood of Darjeeling, in the Chawa Nuddee, about a coss from its junction with the Teesta.

The late Mr. David Scott, Governor General's Agent, Assam, is said by Dr. Campbell to have found coal near the same locality, but a specimen submitted to the coal Committee, and reported on in one of its printed reports, was considered of no value.

My Report on this coal is as follows:—

Report on a specimen of Jet Coal from the Chawa Nuddee, a tributary of the Teesta, forwarded by Dr. A. Campbell *of Darjeeling.*

The specimens sent are very small and are mere surface and rolled specimens, so that there is much difficulty in selecting a bit for a fair test of the Sp. gravity; and those which I have taken are too small. I found also much difficulty in picking fragments entirely free from earthy matter for analysis without destroying the larger specimens which, from a new locality and with a new variety, it is always desirable to keep as entire as possible till a good supply is obtained.

Examination.—This coal is evidently a Jet; but as none of the books to which I have access contain any detailed examination and description even of the common Jet! I have thought it worth while to put this on record as it differs both from massive Jet and from the common Jet Coal.*

Appearance.—The aspect of this coal is very remarkable. A part of it is a bright glancing jet-like coal, which sometimes occurs in entire pieces, though very small ones, not being larger than a large bean or small walnut but in the larger specimen, this bright jet-like and massive coal is seen to pass into curious small columnar jointed concretions, somewhat resembling on a microscopic scale those of basalt.

In certain lights the joints have a very bright, and somewhat pearly glance, with faint traces of rings in them, which are clearly made out by the magnifier. Larger and more distinct traces of these rings are seen on some of the massive jet-like pieces, the whole conveying the impression of large and small globules loosely aggregated under pressure.

Physical Properties.—It burns readily with a fine greenish yellow flame, and the smell of the smoke, though pungent, is in some degree aromatic;† being not at all the *smoky* smell of common coal. It is easily cut, but brittle and flying into fragments. The streak is a dull black.

* See Vol. XX. p. 366, of Journal (Proceedings of April, 1851,) for my examination of an Indian Jet Coal far inferior to this from the Mootee Jhurna falls, Rajmahal Hills.

† Probably containing a little Succinic Acid. ?

When breathed upon, the smell is that of a foul chimney.

Sp. gravity of a specimen of the massive kind, ...	1 02
Of a specimen which was partly massive and partly concretionary,.....	1.03

The constituents of a specimen which was composed of a fair average of the massive and concretionary parts were found to be as follows. In 100 parts,

Water, ...	10.50
Volatile bituminous matter, ...	27.00
Carbon, ...	58.00
Ash, of a dark grey color and effervescing with Acids, ...	4.00
	100.00

A portion of the ash was evidently in coarse siliceous granules, probably from the external coating of the rolled pieces ; so that, the true proportion of ash would probably be about 3.50 per cent. or less.

If found in sufficient quantities this coal would afford a very valuable and agreeable fuel, but would burn too quick, I should think, to be economical ; the powder in the crucible does not coke as that of the bituminous coals often does.

Postscript.—When about to despatch this report, I received from Dr. Campbell a farther supply of the coal, of which the examination quite confirms it. In the larger and more massive pieces, the concretionary structure is clearly visible on the cross fracture, and they have moreover embedded in them some brown amygdaloidal concretions from one to two inches long which are masses of micaceous gravel and carbonaceous matter, cemented to some hardness by a mixture of carbonate of lime. There are some pieces also of the coal veined with carbonate of lime. The quantity of coal to be obtained and the expense of raising and delivering it at the station, are now all that is wanted to be known regarding this deposit. It cokes into a bright shining metallic coke externally which is remarkably fibrous and wood-like ; and in some pieces divides into laminar masses like wood, as if this Jet Coal was produced not from carbonized plants, but from wood.

Dr. Campbell has also sent us specimens of the rock in which the Jet Coal is found. This is a coarse sandstone grit ; much of the character of those of the true coal formations, and is so far promising ; but it contains no organic remains.

H. Piddington.
Curator, Mus. Econ. Geology.

Major Ramsay now resident of Nepal sent me some time ago, as already noticed in a former report, a collection of 96 specimens of rocks and minerals of various kinds, which the minister Jung Bahadur had had collected, and of which he was desirous of knowing the value, as one was supposed to contain tin, &c. but the whole prove to be valueless, except one of a very fine quartz, equal to the best Brazilian pebbles, a splendid white marble, a Kyanite, (sometimes used in jewellery and inlaying work,) a blue copper ore, and the last of the series No. 96, which as I announced before, is certainly a new mineral, even in the form in which it reached us, Major Ramsay has just sent specimens of the ore, which will be examined in due course. The history of this mineral product I reserve for the full account of its examination.

Captain Haughton, 1st Assistant Agent to the Governor-General on the S. W. Frontier, has sent us a large collection of some 50 or 60 ores of copper, iron and lead, from that quarter, which will be duly examined.

Library.

The following books have been added to the Library since the last meeting.

Presented.

Indische Alterthümskünde von Christian Lassen. Zweiter Band. Bonn, 1852. Royal 8vo.—By the Author.

Magnetical and Meteorological Observations made at the Hon'ble East India Company's Observatory, Bombay, in the year 1849. Bombay, 1852, 4to.—By the Superintendent of the Observatory.

Die Handschriften-Verzeichnisse der Koniglichen Bibliothek. Erstes Band. Verzeichnisse der Sanskrita Handschriften von Herrn Dr. Weber. Berlin, 1853, 4to.—By the Author.

Journal of the Royal Geographical Society of London. Vol. XXII.—By the Society.

Jahrbucher der Literatur. Nos. 2, 4, 26, 28, 78, 89, 90 and 92.—By the Baron von Hammer-Purgstall.

Selections from the Public Correspondence of the Board of Administration for the affairs of the Punjab: Nos. 1 and 2. 4 copies each.—By the Board.

Report of the Revenue Administration of the Lower Provinces for the official year 1851-52.—By the Government of Bengal.

Journal of the Indian Archipelago, for October 1852. 2 copies.—By the same.

Ditto ditto, for November 1852.—By the Editor.

Legende de Sakuntala d'apres la version Hindouie de Mahábhárata, par M. Garcin de Tassy. Pamphlet.—By the Author.

Tableau du Kali Yug, ou de l'age de Fer, par Wischnu Das, traduit de l'Hindouie par M. Garcin de Tassy.—By the Author.

Notice sur une carte routiere de Nuschhed à Bokhara et de Bokhara á Balkh par M. Sedillot.—By the Author.

Journal of the Archæological Society of Delhi. January 1853, 2 copies. —By the Society.

Zeitschrift des Deutschen morgenländischen Gesellschaft. Vol. VI. Part 3.—By the Society.

The Vedánta Sutras. Nos. 1 to 6.—By Ba'bu Ja'davakrishna Sinha.

Combe's Constitution of Man translated into Bengali. By Bábu Akshaya Kumár Datta. 1 vol. 12mo.—By the Translator.

Map of the Grand Trunk Road from Calcutta to Benares. By J. Joseph, Esq.—By the Author.

Ditto ditto from Karmanásá to Agra.—By the same.

A map of the Overland route of Steam communication.—By the same.

The Oriental Baptist. Nos. 75, 76.—By the Editor.

The Calcutta Christian Observer. For March and April 1853.—By the Editors.

The Oriental Christian Spectator. For February 1853.—By the Editor.

Abstract of the Meteorological Register for November, 1853.

Rangoon, 1st December, 1853.

	Thermometer Sunrise.			Thermometer 9 A. M.			Thermometer Noon.			Thermometer 3 P. M.			Thermometer Sunset.			Thermometer 9 P. M.			Remarks.
	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	
Wet....	74	66	71.10	77	70	74.10	78	71	75.98	79	71	76.20	78	73	76.0714	81	68.5	75 35	Quantity of rain fallen this month, slight showers on the 16th, 25th and 26th.
Dry....	76	69.5	74.07	83.5	75	79.09	90.5	81.5	86.79	90.5	82.5	88.11	86	81.5	83.714	82	75.5	79	Prevailing winds this month N. E. but occasionally from S. E. on the 30th at 1 P. M. a thunder storm accompanied by a heavy storm of rain. Thermometer fell 7 degrees changed from N. E. to S. W.
	Barometer Sunrise.			**Barometer 9 A. M.**			**Barometer Noon.**			**Barometer 3 P M.**			**Barometer Sunset.**			**Barometer 9 P. M.**			
	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	
	30.17	30.01	30 07	30.14	30.04	30.09	30.15	30.02	30.07	30.07	29.98	30.03	30.06	30	30.03	30.12	30.03	30.07	
	Of 29 observations.			Of 29 observations.			Of 29 observations.			Of 23 observations.			Of 7 observations.			Of 26 observations.			

J. Fayrer, M D. *Asst. Surg. Field Hospital, Rangoon.*

Rangoon, 1st December, 1852.

Date.	Sunrise.					9 A. M.					Noon.				
	Thermometer.		Aneroid Barometer.	Force and direction of Wind.	Aspect of Sky.	Thermometer.		Aneroid Barometer.	Force and direction of Wind.	Aspect of Sky.	Thermometer.		Aneroid Barometer.	Force and direction of Wind.	Aspect of Sky.
	Wet.	Dry.				Wet.	Dry.				Wet.	Dry.			
1	72	75	30.09	Calm.	Clear.	76	81	30.10	E. lt.	Clear.	78	87	30.07	E. lt.	Cir.-cuml.
2	71	74.5	.09	Ditto.	Ditto.	76 5	80.5	.11	N. E. do.	Ditto.	77.5	86.5	.09	N. b. E. do.	Ditto.
3	74	74	.09	N. E. lt.	Ditto.	75 5	80	.11	Ditto.	Ditto.	76	88 5	.09	N. E. do.	Ditto.
4	71	75	.10	Ditto.	Ditto.	75	80	.11	Ditto.	Ditto.	76	87	.10	Ditto.	Ditto.
5	72	75	.09	Ditto.	Ditto.	74 5	77.5	.11	Ditto.	Cirri-cuml.	77	88	.15	Ditto.	Cumuli.
6	72	75	.09	Ditto.	Ditto.	77	80 5	.11	Ditto.	Ditto.	76	87	.10	Ditto.	Ditto.
7	72	75	.10	Ditto.	Ditto.	75	79	.12	N. E.	Ditto.	76	88	.09	Ditto steady.	Ditto.
8	73	76	.10	Ditto.	Ditto.	75.5	81 5	.12	Ditto.	Ditto.	..	..	..	....	....
9	72	75	.17	Ditto.	Ditto.	74	78	.12	Ditto.	Clear.	75.5	90	.05	N. E. steady.	Cumuli.
10	72	75	.09	Ditto.	Ditto.	73.5	75.5	.09	Ditto.	Ditto.	76	87	.07	Ditto.	Ditto.
11	71	74	.09	Ditto.	Ditto.	..	..	..	.. .	....	77	87.5	.09	N. E. lt.	Ditto.
12	72	76	.05	Ditto.	Ditto.	75	80	.09	N. E. lt.	Clear.	77	89	.03	Ditto.	Ditto.
13	72	74	.05	Ditto.	Ditto.	73	78	.06	Ditto.	Ditto.	76	86	.05	Ditto.	Ditto.
14	71	75	.06	Ditto.	Ditto.	75.5	83	.08	Ditto.	Ditto.	77	87.5	.05	Ditto.	Cirri-cuml.
15	72	76.5	.06	N. lt.	Ditto.	76	83.5	08	N. do.	Ditto.	77	88	.06	Ditto.	Ditto.
16	72	76	.07	Calm.	Ditto.	75 5	82	09	N. E. do.	Ditto.	76	87 5	.05	Ditto.	Ditto.
17	72	74	.06	N. W. lt.	Ditto.	77	83	.07	N. do.	Ditto.	78	86	.03	N. do.	Ditto.
18	72	75 5	.03	Calm.	Ditto.	76	81.5	.07	N E. do.	Ditto.	76.5	90.5	.02	S. S. W. do.	Ditto.
19	71	73.5	.01	Ditto.	Ditto.	75	80.5	.04	Calm.	Ditto.	75	85.5	.02	Calm.	Ditto.
20	69.5	71	.03	Ditto.	Hazy.	72	76.5	.06	Ditto.	Ditto.	74	87	.03	N. W. lt.	....
21	67.5	69 5	.05	Ditto.	Ditto.	72	77	.08	Ditto.	Ditto.	72	83.5	.05	N. do.	Clear.
22	66	70	.06	Ditto.	Ditto.	70	75.5	.10	Ditto.	Ditto.	72	84.5	.07	N. W. do.	Ditto.
23	68	71.5	.06	Ditto.	Ditto.	70	77 5	.10	N.W. b. N.lt.	Ditto.	71	86.5	.07	Ditto.	Ditto.
24	67.5	71	.06	Ditto.	Ditto.	70.5	77	.10	N. E. lt.	Cirri.	74.5	84.5	.07	Ditto.	Cirri.
25	71	73.5	.07	N. E. lt.	Cirri-cuml.	74.5	75	.11	Ditto.	Ditto.	77 5	84.5	.11	E do.	....
26	73 5	76	.10	Calm.	Cirri.	75	81	.14	Ditto.	Cirri-cuml.	77	85.5	.11	N. E. do.	Cumuli.
27	71	74	.07	Ditto.	Ditto.	71.5	75	.11	Ditto.	Ditto.	76.5	85.5	.07	Ditto.	Ditto.
28	71	73.5	.06	Ditto.	Ditto.	70.5	76	.10	Ditto.	Cirri.	76	87	.07	Calm.	Ditto.
29	71	74	.06	Ditto.	Ditto.	73.5	79	.07	Ditto.	Ditto.	76.5	86	.05	N E. lt.	Cirri.
30	..	..	..	..	....	74	79	.07	Ditto.	Ditto.	79	89	.04	E b. N. in.	Cumuli.
Total.	2062	2148	872.11	....	....	2149	2293.5	872.72	. ..	....	2203.5	255.70	871.95	....	....
Mean.	71.10	74.07	30 07	....	....	74.10	79.19	30.09	....	....	75.98	86.79	30.07	....	

J. Fayrer, M. D.

3 P. M.					Sunset.					9 P. M.					
Thermometer		Aneroid Barometer.	Force and direction of Wind.	Aspect of Sky.	Thermometer.		Aneroid Barometer.	Force and direction of Wind.	Aspect of Sky.	Thermometer.		Aneroid Barometer.	Force and direction of Wind.	Aspect of Sky.	Remarks.
Wet.	Dry.				Wet.	Dry.				Wet.	Dry.				
77	88	30.05	E. lt.	Cirri.	76	82	30.05	N. E. lt.	Clear.	74	79	30.09	Calm.	Clear.	Hot, fine evening.
77.5	90.5	.05	N. E. do.	C.-cum.	..	..	..	..	..	75	80.5	.09	Ditto.	Ditto.	Hot.
..	..	..	..	..	..	..	..	..	..	74	80	.10	Ditto.	Ditto.	Ditto.
75 5	88.5	.06	Ditto.	Ditto.	..	..	..	..	..	74	78.5	.12	N. E. lt.	Ditto.	Ditto.
..	..	..	..	..	..	..	..	..	..	73	76	.10	S. E. do.	Ditto.	Cool
75.5	89	.07	Ditto.	Ditto.	..	..	..	..	..	73	75.5	.10	Ditto.	Ditto.	Hazy after Sunrise.
76	89.5	.07	Ditto.	Ditto.	..	..	..	..	..	73	76	.10	Ditto.	Ditto.	Fine cool breeze.
..	..	..	..	..	..	..	..	..	..	74	81	.11	Ditto.	Ditto.	Ditto.
75	90	.03	Ditto.	Ditto.	77.5	81.5	.06	N. E. v. lt.	..	75.5	82	.09	Ditto.	Ditto.	Ditto.
78	88.5	.04	Ditto.	Ditto.	..	..	..	S. E. do.	..	76	82	.08	Ditto.	Ditto.	
..	..	..	..	..	..	..	..	Ditto.	Cumuli.	76	82	.10	Ditto.	Ditto.	
..	..	..	..	..	..	..	..	..	..	75	79	.09	Ditto.	Ditto.	Ditto.
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	Ditto.
75	89.5	.02	E. lt.	C.-cum.	..	..	..	..	..	74.5	80	.07	N. E. lt.	Ditto.	Sun covered-cooler.
77	88.5	.02	N. E. do.	Ditto.	78	85	.05	N. v. lt.	..	76	81	.07	Calm.		[E. at 2 o'clock.
78	86	.02	N.W. v. do.	Ditto.	77	84	.03	Calm.	Clear cld. in west.	75.5	80.5	.07	Ditto.	Clear.	A very slight Sh. from
78	89.5	.00	N. do.	Ditto.	..	..	..	..		76	82	.04	Ditto.	Ditto.	Cloudy. [refg. breeze.
78	90	29 98	N. W. do.	Ditto.	77	85.5	.00	Calm.	..	76 5	82	.03	Ditto.	Ditto.	Slight air. S. S. E.
75.5	89	.98	Calm.	Ditto.	..	..	..	..	..	75	79.5	.03	Ditto.	Ditto.	Therm. outside 70.
73	88.5	.98	N. W. lt.	..	73	82	.02	Calm.	Clear.	68.5	76	.04	N.W. v. lt.	Ditto.	Strati very thin and
71	87.5	30.02	Ditto.	Clear.	..	..	..	..	..	70.5	77	.07	Ditto.	Ditto.	light.
72	88	.03	Ditto.	Ditto.	..	..	..	..	..	71	77.5	.07	Calm.	Ditto.	Fog banks in distance.
74.5	88.5	.02	Ditto.	..	..	..	..	..	..	72	78	.06	Ditto.	Ditto.	Thin vaporing clouds.
75.5	80.5	.06	E. b. S. lt.	..	..	..	..	..	..	..	..	..	..	..	Cumuli-strati shower.
79	88.5	.06	Calm.	Cumuli.	..	..	..	..	..	..	..	..	..	..	Few drops past over.
76	87	.06	..	Cirri.	..	..	..	..	..	81	76	.05	N. lt.	Clear.	
78	89	.03	N. E. lt.	Ditto.	..	..	..	..	..	81	76	.05	Ditto.	Ditto.	
79	90	.00	Ditto.	Ditto	74	86	02	N.W.W. lt.	Clear.	81	76	.05	Ditto.	Ditto.	
78.5	82.5	.02	S. W. do.	Cumuli.	..	..	..	..	..	78	81	.07	E. lt.	Cumuli.	Thunder in distance.
1752.5	2026.5	6906.7	..	..	532.5	586	..	..	..	194.90	205.40	781.94			
76.20	88 11	80.03	..	..	76.0714	83.7143	..	..	..	75.35	79.	30.07			

On 25th and 26th, in the afternoon, showers of rain fell.

At 1 P. M. 30th Thunder storm with heavy shower of rain. Thermometer fell 7 degrees.

Wind changed suddenly from N. E. to S. W.

Abstract of the Meteorological Register for December, 1852.

Rangoon, 1st January, 1853.

	Thermometer Sunrise.			Thermometer 9 A. M.			Thermometer Noon.			Thermometer 3 P. M.			Thermometer Sunset.			Thermometer 9 P. M.			Remarks.
	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	
Wet.	74	60	66.53	77	61	68.95	80	66	69.22	81	65	72.24	71	69	69.83	77	63	69.25	Rain. Showers (Quantity 0.21.)
Dry...	78	62	67.70	80	67	74 83	89	73 5	83.95	90	82	85.71	80	78	79.33	89	71	76.75	Prevailing wind E. to N. E. Hot in the middle of the day, but cold at night.

	Barometer Sunrise.			Barometer 9 A. M.			Barometer Noon.			Barometer 3 P. M.			Barometer Sunset.			Barometer 9 P. M.			
	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	Maximum.	Minimum.	Mid.	
	30.13	30.05	30.09	30.16	30.07	30.13	30.14	30.07	30.09	30.12	30.03	30.07				30.00	30.09	30.10	Weather fine and clear for the most part.
	Barometrical observations 10 in number. Thermometrical 20. Bar. obs. 10 in number.			Thermometrical observations 20.			Bar. 12 observations. Thermometer 22 observations.			Bar. 11 observations. Thermometer 17 observations.			Barometer none, Thermometer 3 observations.			Bar. 3 observations. Thermometer 8 observations.			

J. Fayrer, M. D.
Assistant Surgeon, Field Hospital.

Meteorological Observations for the Month of December, 1852.

Rangoon, 1st January, 1853.

Date.	Sunrise. Thermometer. Wet.	Sunrise. Thermometer. Dry.	Sunrise. Aneroid Barometer.	Sunrise. Force and direction of Wind.	Sunrise. Aspect of Sky.	Sunrise. Rain.	9 A. M. Thermometer. Wet.	9 A. M. Thermometer. Dry.	9 A. M. Aneroid Barometer.	9 A. M. Force and direction of Wind.	9 A. M. Aspect of Sky.	Noon. Thermometer. Wet.	Noon. Thermometer. Dry.	Noon. Aneroid Barometer.	Noon. Force and direction of Wind.	Noon. Aspect of Sky.
1	74.5	78	30.07	N. E. lt.	Cumuli.	020	77	80	30.07	E.b.N.lt	Cirri.	79	85	30.10	N.b.N. lt.	Cumuli.
2	..	..	..	..	..	..	76	81	.10	E. lt.	Ditto.	80	89	.07	E. lt.	Cirri.
3	75	78	.09	N. E. lt.	Cumuli.	..	76	78	.13	N. lt.	Cumul.	77	86	.07	E.N.E.lt.	Cumuli.
4	72	74	.09	Ditto.	Ditto.	.	75	78	.14	E. lt.	Ditto.	79	87	.11	E. lt.	Clear.
5	72	72	.13	E. do.	Cirri.	01	..	..	..	..	..	73	73.5	.14	N. E. fr.	Cirri.
6	65	67.5	.13	N. E. do.	Clear.	..	..	..	..	..	..	70	83	.12	Ditto.	Ditto.
7	65	67.5	.10	Calm.	Ditto.	.	68	74	.15	N. E. lt.	Cirri.	70	83	.10	N. E. do.	Clear.
8	65	68	.09	Ditto.	Ditto.	..	68	74	.12	Ditto.	Ditto.	70.5	83	.08	Ditto lt.	Ditto.
9	65	68	.07	Ditto.	Ditto.	..	68	73	.12	Ditto.	Ditto.	72.5	84	.07	Ditto.	Ditto.
10	65	61	.05	Ditto.	Ditto.	..	67	70	.16	Ditto.	Ditto.	72	82	.07	Ditto.	Ditto.
11	..	..	..	..	..	..	.	..	..	..	..	74.5	84	.10	..	..
12	..	..	..	..	..	..	72	78	.13	N.E. stdy.	Cirri.	1	..	..	..	..
13	79	74	.07	N. by W.	C.-Cuml.	..	72	78	.14	Ditto.	Ditto.	..	..	..	..	..
14	..	..	..	..	..	..	..	..	..	..	..	75	88	.07	..	..
15	..	..	..	..	.	..	..	..	..	..	..	..	..	..	..	..
16	..	..	..	..	..	..	..	..	..	..	..	73	88	None.	N. E. lt.	C.-cumul
17	67	68	None.	N. E. lt.	Clear.	..	..	..	..	..	..	74	86	Ditto.	Ditto.	Ditto.
18	65.5	67.5	..	Ditto.	Cirri.	..	74	78.5	None.	N.E. stdy	Cirri.	..	..	..	..	..
19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
20	60	64	..	N. E. lt.	Cirri.	..	63	69.5	None.	N. E. fr.	Cirri.	65	80.5	..	N. E. fr.	Cumuli.
21	60.5	65	..	Ditto.	Ditto.	..	..	..	..	..	..	66	83	..	Ditto lt.	Cirri.
22	..	..	..	..	..	..	66	75	None.	N. E. lt.	Cirri.	..	..	..	..	..
23	63	66.5	..	N. E. lt.	Cirri.	..	68	78	..	Ditto.	Ditto.	69	83	..	N. E. lt.	Cirri.
24	..	..	..	Ditto.	Cumuli.	..	68	73	N. E.	Ditto.	Cumul	73	85	..	Ditto.	Cumuli.
25	..	..	..	..	..	..	68	72	Ditto.	Ditto.	Cloudy	74	85	..	..	Cirri.
26	57.5	63	..	N. E. lt.	Cirri.	..	61	67	Ditto.	Ditto.	Cirri.	..	..	..	..	..
27	59	62	..	Ditto.	Ditto.	..	66	77.5	Ditto.	Ditto.	Ditto.	..	..	..	..	..
28	78.5	62	..	Ditto.	Ditto.	..	62	67	Ditto.	Ditto.	Ditto.	71.5	85	..	N. E. lt.	Cirri.
29	62	64	..	Ditto.	Ditto.	..	..	..	..	..	.	..	..	..	..	..
30	..	..	..	..	..	..	..	..	..	..	.	67	83	..	N. E lt.	Cirri.
31	60	64	..	N. E. do.	Cirri.	..	63	75	Ditto.	Ditto.	Ditto.	66	81	..	Ditto.	Ditto.
Total.	1330.5	1354	300.89			0.21	1378	1496.5	301.26			1592	1847	361.10		

3 P. M.					Sunset.					9 A. M.					
Thermometer.		Aneroid Barometer.	Force and direction of Wind.	Aspect of Sky.	Thermometer.		Aneroid Barometer.	Force and direction of Wind.	Aspect of Sky.	Thermometer.		Aneroid Barometer.	Force and direction of Wind.	Aspect of Sky.	Remarks.
Wet.	Dry.				Wet.	Dry.				Wet.	Dry.				
81	89	30.06	E.b.N. lt.	Cumuli.	..	..	..	..	..	77	89	30.10	Calm.	Cumuli.	Shower fell yesterday,*
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	Light.
78	88	.07	S. lt.	Cumuli.	..	..	..	..	..	77	81	.09	S. W.	Clear.	
77	87	.08	E.b.N.lt.	Ditto.	..	..	..	..	..	..	..	..	..	..	Clear.
73	85	.12	E.N. E. lt.	Cirri.	..	..	..	..	..	..	..	..	..	..	Rain last night.
71.5	85	.09	N.E. stdy.	Ditto.	..	..	..	..	..	70	80	.10	N. W. lt.	Cirri.	Cool night. [clear.
71	84	.06	N. E. do.	Clear.	..	..	..	..	..	..	..	..	..	..	Beautifully cold and
72	85	.06	Ditto.	Ditto.	..	..	..	..	..	..	..	..	..	..	Clear weather.
73	85	.05	Ditto lt.	Ditto.	..	..	..	..	..	..	..	..	..	..	Hazy.
73	88	.03	Ditto.	Ditto lt.	..	..	..	..	..	..	..	..	..	..	Small whirwind travelling in Circular direction round Field Hospital with considerable force.
..	..	.	..	..	..	..	..	..	..	..	..	..	..	..	
75	90	.06	N. E.	Cumuli.	..	..	..	..	..	..	..	..	..	..	
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
75	89.5	.05	N. E. lt.	Cumuli.	..	..	..	..	..	..	..	..	..	..	
..		..	..		..	..	..	..	..	.	..	..	..	..	Field Hos. removed†
..		..	..		..	..	..	..	..	..	..	..	..	..	
..		None.	..		..	..	..	..	..	..	..	..	..	..	Cold clear evening.
..		..	..		..	..	..	..	..	..	..	..	..	..	
..		..	..		..	..	..	..	..	..	..	..	..	..	[evening cold.
65	80	..	..	H.cumuli.	..	..	..	..	..	63	71	N.E. lt.	Cirri.	Clear N.	Cloudy and hazy; in
65	82	..	N. E. lt.	Cumuli.	..	..	..	..	..	..	..	..	..	..	
70	85.5	..	Ditto.	Cirri.	69	80	None.	N. E. lt.	Cirri.	..	..	..	..	..	
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	Hazy. [just over.
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	Cloudy light shower
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	Close evening.
..	..	..	..	..	..	..	..	..	..	67	74	Ditto.	..	..	Eclipse of Moon.
73	86	..	N. E. lt.	Cumuli.	71	80	..	Ditto.	Cirri.	..	..	..	..	..	
69	86	..	Ditto.	Cirri.	69.5	78	..	Ditto.	c.-cuml.	67	73	Ditto.	Ditto.	Ditto.	
..	..	..	..	Ditto.	..	..	..	..	..	66	73	Ditto.	Ditto.	Ditto.	
67	82	..	Ditto.	Ditto.	..	..	..	..	..	67	73	Ditto.	Ditto.	Ditto.	
..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	Hazy.
12285	1457	380.73			219.5	238				554	614				
72.24	85.7	30.07			69.83	79.33				69.25	76.75	30.10			

* cloudy and overcast, thunder in distance at 2 P. M.

† inside Stockade to Barrack of Madras Fusileers; Barometer removed.

Meteorological Register kept at the Office of the Secretary to Government N. W. P. Agra, for the Month of November 1852.

Maximum pressure observed at 9.50 A. M.

Date.	Barometer.	Temperature.			Maximum and Minimum.			Aspect of the sky.
		Of Mercury.	Of Air.	Wet Bulb.	Maximum.	Minimum.	Direction of the Wind.	
1	29.461	78.4	77.1	62.0	..	..	W.	Clear sky.
2	29.475	78.0	78.6	61.4	..	..	W.	Ditto ditto.
3	29.497	76.7	76.2	61.1	..	..	W.	Ditto ditto.
4	29 483	77.0	78.4	62.0	..	..	W.	Few \ to S.
5	29.501	76.8	76.1	62.6	..	..	Ld.	Clear sky.
6	29 472	79 2	81.5	65.0	..	..	W.	Ditto ditto.
7	29.548	79.0	77.6	64.5	..	..	E.	Ditto ditto.
8	29.567	77 0	76.5	65.1	..	..	W.	Ditto ditto.
9	29 530	75.5	78.0	64.7	..	..	N.W.	Ditto ditto.
10	29.509	75.2	74.0	63.2	..	..	Ld	Ditto ditto.
11	29 483	75.0	75.4	63.4	..	..	W.	Ditto ditto.
12	29 565	74.5	75 3	63.8	..	..	W.	Ditto ditto.
13	29.449	75.0	75.3	64.6	..	..	W.	Ditto ditto.
14	29.453	77.4	74.5	63.0	..	..	W.	Ditto ditto.
15	29.470	75.8	75.9	64.5	..	..	W.	Ditto ditto.
16	29.451	76.5	75.6	65.0	..	..	S.W	Ditto ditto.
17	29.434	76.0	76.0	65.5	..	..	N.	∩ in zenith.
18	29.349	77.5	76.0	69 0	..	..	E.	∩ in zenith.
19	29.397	76.9	78.2	66.5	..	..	N.	Clear sky.
20	29.425	73.5	71.3	60.5	..	..	W.	Ditto ditto.
21	29 490	75.7	72.5	60.0	..	..	S.	Ditto ditto.
22	29.507	74.5	74.5	62.8	..	..	W.	Ditto ditto.
23	29.535	74.0	72.3	61.6	..	..	S.W.	Ditto ditto.
24	29 543	74.0	70 0	58.5	..	..	W.	Ditto ditto.
25	29.565	71.0	69.4	57 5	..	..	W.	_ ¼ scattered over.
26	29.610	69.3	66.5	55 8	..	..	Ld.	\~ all over.
27	29.578	70.0	67.5	56.4	..	..	W.	Clear.
28	29 526	70.0	67.0	56.2	..	..	W.	Ditto.
29	29.558	69.0	67.5	54.0	..	..	N.	Ditto.
30	29.540	68.8	66 0	53.5	..	..	N.	Ditto.
Mean.	29.506	74.90	74.02	61.79	..	..	..	

Note. The symbols used for Aspect of the sky are

\ for Cirri — for strata

∩ for Cumuli _ for Cirro-strata

\~ for Cumulo-strata ~ for Nimbi

The Barometer readings have all been reduced to 32° Far. and corrected for Capillary Action.

M. Sherer, *Asst. Secy. to Govt. N. W. P.*

Meteorological Register kept at the Office of the Secretary to Government N. W. P. Agra, for the Month of Nov. 1852. LATITUDE.

Observations at apparent Noon.

Date.	Barometer.	Temperature. Of Mercury.	Of Air.	Wet Bulb.	Maximum and Minimum. Maximum.	Minimum.	Direction of the Wind.	Aspect of the sky.
1	29.421	80.2	81.5	63.5	..	..	W.	Clear sky.
2	29.439	80.0	80.4	61.7	..	..	N.	Ditto ditto.
3	29.454	78.9	80.7	62.6	..	..	W.	Ditto ditto.
4	29.453	78.4	78.4	62.6	..	..	W.	⌣ over $\frac{2}{3}$ of sky.
5	29 436	78.5	80.0	63.4	..	..	Ld.	Clear sky.
6	29.425	80.0	80.0	62.0	..	..	W.	Ditto ditto.
7	29.522	79.2	78.5	65.3	..	..	E.	Ditto ditto.
8	29.521	78.2	78.4	64.5	..	..	W.	Ditto ditto.
9	29.479	78.4	78.5	63.5	..	..	W.	Ditto ditto.
10	29.380	77.0	76.9	63.5	..	..	Ld.	Ditto ditto.
11	29.445	76.6	77.1	63.6	..	..	W.	Ditto ditto.
12	29.468	75.5	78.6	64.6	..	..	W.	Ditto ditto.
13	29 389	76.5	77.5	64.3	..	..	W.	Ditto ditto.
14	29.415	77.7	76 0	63.9	..	..	W.	Ditto ditto.
15	29.419	77.2	78.0	64.9	..	..	W.	Ditto ditto.
16	29.405	77.5	80.9	66.5	..	..	N.	Ditto ditto.
17	29 387	77.7	78.5	66 2	..	..	W.	⌢ to N. E.
18	29.317	78.0	77.0	69.0	..	..	S.	Clear sky.
19	29.351	77.8	77.5	67.0	..	..	S.	Ditto ditto.
20	29.371	75.2	74.7	64.5	..	..	S.	Ditto ditto.
21	29.450	76.0	74.9	60.6	..	..	E.	Ditto ditto.
22	29.430	75.5	76.8	64.5	..	..	W.	Ditto ditto.
23	29.487	75.4	75.5	62.5	..	..	N.	Ditto ditto.
24	29.497	74.0	74.0	59.9	..	..	N.	Ditto ditto.
25	29.528	72.8	72.5	59.3	..	..	W.	⌣ $\frac{1}{3}$ scattered over.
26	29.591	71.0	69.0	57.3	..	..	Ld.	⌢ to S. ⌢ E. W. and N.
27	29.523	71.0	70.5	56.5	..	..	W.	Clear.
28	29.428	71.5	70.0	57.5	..	..	N.W.	Ditto.
29	29.506	70.0	70.5	54.8	..	..	N.	Ditto.
30	29.508	70.0	70.0	54.5	..	..	W.	Ditto.
	29.448	76.19	76.43	62.48	..	..	..	

Meteorological Register kept at the Office of the Secretary to Government N. W. P. Agra, for the Month of Nov. 1852. LONGITUDE.

Minimum pressure observed at 4 P. M.

Date.	Barometer.	Temperature.			Maximum and Minimum.			Aspect of the sky.	Rain Gauges.	
		Of Mercury.	Of Air.	Wet Bulb.	Maximum.	Minimum.	Mean.		3 feet 2 inches from the ground.	Direction of the Wind.
1	29.360	82.2	82.5	62.5	81.5	65.4	73.45	Clear sky.		W.
2	29.371	80.9	81.9	63.5	82.8	64.2	73.5	\ to S. a few.		W.
3	29.386	82.0	81.9	62.6	82.5	65.6	74.05	Clear sky.		W.
4	29.392	82.0	82.5	64.2	82.2	62.2	72.2	∿ to E. W. and N. ∿ to S.		W.
5	29.364	82.0	81.0	63 9	79 9	64.1	72.0	Clear sky.		Ld.
6	29.383	80.0	80.9	63.3	80.9	65.5	73 2	Ditto ditto.		W.
7	29.459	79.8	78.9	64.8	85.5	62.3	73.9	Ditto ditto.		E.
8	29.430	79.0	79.0	64.5	79.2	66.0	72.6	Ditto ditto.		W.
9	29.392	78.9	78.6	64.0	78.0	62.7	70.35	Ditto ditto.		W.
10	29.386	79.0	78.5	63.4	78.1	63.0	70.55	Ditto ditto.		W.
11	29.381	80.0	78.0	64.1	77.8	62.0	69.9	Ditto ditto.		W.
12	29.375	77.5	78.6	64.3	78.2	61.0	69.6	Ditto ditto.		W.
13	29.316	78.5	78.5	64.0	78.0	63.5	70.75	Ditto ditto.		W.
14	29.357	78.0	78.0	64.3	77.6	64.0	70.8	Ditto ditto.		W.
15	29.349	79.6	80 5	65.2	80.3	65.0	72.65	Ditto ditto.		
16	29.337	79.8	80.0	66.5	79.5	64.5	72.0	Ditto ditto.		N.
17	29.306	78.5	81.7	66 5	80.5	65.0	72.75	∿ to N. E.		W.
18	29.262	79.0	79.0	68.2	78.7	70.0	74.35	∿ in zenith.	16	N.
19	29.290	78.8	78.0	63.0	77.2	65.8	71.5	Clear sky.		W.
20	29.317	76.8	76 4	59 5	75 5	69.5	72.5	Ditto ditto.		S.
21	29.381	76.5	74.7	61.5	75.3	64.4	69.85	Ditto ditto.		E.
22	29.394	78.5	78.5	65.0	78.6	63 6	71.10	∩ ⅓ scattered over.		W.
23	29.407	76.5	77.2	60.3	75.8	69.0	72.4	Clear.		N.
24	29.414	75.7	75.4	60.3	75.2	63.2	69.2	∽ ¼ scattered over.		W.
25	29.461	74.	73.5	59 2	73.4	57.	65.2	∽ ⅛ ditto.		W.
26	29.512	72.5	70.8	58.2	70.0	58.0	64.0	∿ to S. ∿ E. W. and N.		Ld.
27	29.434	72.0	71.5	58.5	72.0	56.0	64.0	Clear.		W.
28	29.412	72.5	72.8	60.0	72.2	57 2	64.7	∿ to N. W.		N.
29	29.424	72.8	72.0	56.5	72.0	56.6	64.3	Clear.		N.
30	29.447	71.0	70.8	55.8	71.2	52.0	61.6	Ditto.		W.
	29.383	77.81	77.72	62.59	77.65	62 94	70.295		16	

Meteorological Register kept at the Office of the Secretary to Government N. W. P. Agra, for the Month of December 1852.

Maximum pressure observed at 9.50 A. M.

Date.	Barometer.	Temperature.			Maximum and Minimum.			Aspect of the sky.
		Of Mercury.	Of Air.	Wet Bulb.	Maximum.	Minimum.	Direction of the Wind.	
1	29.609	67.1	65.0	52.2	..	..	N.W.	Clear.
2	29.610	65.8	62.4	50.1	..	..	W.	Clear sky.
3	29.566	55 8	60.8	63 6	..	..	W.	Ditto.
4	29 579	61.0	61.0	49.7	..	..	W.	Ditto.
5	29.596	66 0	61.0	50.0	..	..	E.	\ $\frac{1}{4}$ scattered.
6	29.551	61.0	58.4	54.2	..	..	W.	∿ all over sky.
7	29.595	61.0	60 5	56.7	..	..	W.	∿ all over.
8	29.527	63.9	64.0	59.4	..	..	Ld.	∿ to N. W.
9	29.512	63.0	64.2	59.7	..	..	W.	Clear.
10	29.494	63.2	63.4	56.8	..	..	W.	Ditto.
11	29.514	63.0	63.4	55.8	..	..	s.w.	Ditto.
12	29.563	64.5	64.0	55.0	..	..	W.	Ditto.
13	29.629	62.0	63.0	54.0	..	..	W.	Ditto.
14	29.561	62.0	62.8	54.5	..	..	W.	Ditto.
15	29.517	64.0	63.5	55.0	..	..	S.	Ditto.
16	29.643	60 9	61.0	55.0	..	..	N.	Ditto.
17	29.618	60.0	60.5	51.5	..	..	W.	Ditto.
18	29.607	59.0	60.0	50 5	..	..	W.	Ditto.
19	29.599	62.0	61.5	51.5	..	..	W.	Ditto.
20	29.665	52.0	52 5	48.5	..	..	W.	Ditto.
21	29.691	52.0	52.5	48.0	..	..	W.	Ditto.
22	29.595	58.0	58.5	48 0	..	..	W.	Ditto.
23	29.547	58.0	58.5	49.3	..	..	W.	Ditto.
24	29.527	57.5	58.5	49.0	..	..	W.	Ditto.
25	29.569	61.0	60.0	50.8	..	..	W.	\ all over.
26	29.616	59.5	59.5	51.2	..	..	N.	Clear.
27	29 645	58.2	58.5	50.0	..	..	N.	Ditto.
28	29.561	57.7	58.0	49.7	..	..	S.	_ a few scattered.
29	29.558	59.9	59.8	51.0	..	..	E.	∼ $\frac{1}{2}$ scattered.
30	29,590	59.7	59.5	51.5	..	..	Ld.	_ scattered.
31	29.523	62.0	62.0	54.5	..	..	E.	∿ all over.
Mean.	29.580	60.67	60.59	52.47	..	..	..	

Jas. Muir, *Asst. Secy. to Govt. N. W. P.*

Meteorological Register kept at the Office of the Secretary to Government N. W. P. Agra, for the Month of Dec. 1852. LATITUDE.

Observations at apparent Noon.

Date.	Barometer.	Temperature.			Maximum and Minimum.			Aspect of the sky.
		Of Mercury.	Of Air.	Wet Bulb.	Maximum.	Minimum.	Direction of the Wind.	
1	29.551	69.0	67.8	52.5	..	..	N.W.	Clear.
2	29.561	67.3	66.5	51.1	..	..	W.	Clear sky.
3	29.511	66.5	63.9	51.0	..	..	W.	\— scattered all over.
4	29.565	64.3	66.9	51.5	..	..	W.	Clear sky.
5	29.536	66.4	66.4	54.0	..	..	E.	\ ¾ scattered.
6	29.510	63.8	60.0	55.2	..	..	W.	\~ all over.
7	29.532	62.8	59.4	57.2	..	..	W.	Ditto.
8	29.457	65.1	64 5	60.0	..	..	W.	Ditto.
9	29.446	66.0	65.9	61.2	..	..	N.	~ scattered.
10	29.455	67.0	66.5	56.0	..	..	W.	Clear.
11	29.475	65.0	63.8	55.5	..	..	W.	Ditto.
12	29.510	65.5	64.5	56.0	..	..	N.	Ditto.
13	29 583	65.0	64 2	53.4	..	..	W.	Ditto.
14	29.511	64.6	65.0	54.6	..	..	W.	Ditto.
15	29.486	65.5	64.9	56.0	..	..	S.	Ditto.
16	29.603	64.0	64.3	55.5	..	..	S.W.	Ditto.
17	29.563	64.0	64.5	52.3	..	..	N.	Ditto.
18	29.549	62.0	61.7	50.5	..	..	W.	Ditto.
19	29.548	63.0	62.0	50.0	..	..	E.	Ditto.
20	29.609	60.5	60.7	50.1	..	..	W.	Ditto.
21	29.621	60.0	60.5	49.0	..	..	W.	Ditto.
22	29.545	60.5	60.9	50.5	..	..	W.	Ditto.
23	29.496	60.0	59.3	49.3	..	..	W.	Ditto.
24	29.469	60.9	61.0	51.0	..	..	N.W.	\ a few scattered.
25	29.510	62.5	62.2	52.5	..	..	W.	\ ½ scattered.
26	29.529	62.0	62.3	52.2	..	..	N.W.	Clear.
27	29.575	60.8	60.2	51.4	..	..	S.W.	Ditto.
28	29.491	60.7	60.2	50.9	..	..	W.	\— a few scattered.
29	29.527	62.0	60.5	51.7	..	..	E.	\~ all over.
30	29.547	61.0	60.6	52.5	..	..	N.	\— scattered.
31	29.506	63.0	62.8	55.5	..	..	E.	\~ all over.
	29.528	63 57	63.03	53.23	..	..	..	

Meteorological Register kept at the Office of the Secretary to Government N. W. P. Agra, for the Month of Dec. 1852. LONGITUDE.

Minimum pressure observed at 4 P. M.

Date.	Barometer.	Temperature.			Maximum and Minimum.			Aspect of the sky.	Rain Gauges.	
		Of Mercury.	Of Air.	Wet Bulb.	Maximum.	Minimum.	Mean.		3 feet 2 inches from the ground.	Direction of the Wind.
1	29.474	70.4	70.4	53.9	71.3	54.0	62.65	Clear.		N.W.
2	29.478	69.0	67.9	53.0	67.3	46.2	56.75	Clear sky.		W.
3	29.453	67.5	65.5	53.3	66.5	45.7	56.1	⌣ scattered all over.		W.
4	29.471	66.5	67.7	53.5	67.0	45.5	56 3	Clear sky.		W.
5	29.446	66.0	66 5	53.4	66.4	45.7	56.05	\ a few scattered.		W.
6	29.477	65.0	61.0	57.0	61.5	51.2	56.35	⌣ all over.		E.
7	29 469	65.0	62.0	58.0	62.3	54.8	58.55	Ditto.	0.42	W.
8	29.434	66.0	65.0	60.2	64.3	59.4	61.85	Ditto.		W.
9	29.407	66.7	64.7	61.2	66.3	56.5	61.4	∩ a few scattered.		W.
10	29 589	67.0	68.5	57.0	66.8	55.4	61.1	Clear.		W.
11	29.442	66.1	65.2	56.4	64.4	59.8	62.1	⌣ towards W. and S. along horizon.		S. W.
12	29.502	66.0	65.4	57.5	63.5	62.5	63.0	Clear.		N.W.
13	29.510	65.7	65.0	55.2	64.2	57.7	60.95	Ditto.		W.
14	29.425	66.6	67.0	55.6	65.5	55.0	60.25	Ditto.		W.
15	29.431	67.0	67.5	58.0	66.2	58.0	62.1	∩ towards W. & S.		S.
16	29.535	67.5	67.2	55.5	67.1	57.3	62.2	Clear.		N.
17	29.477	67.0	66.7	52.6	66.0	56.0	61.0	Ditto.		N.W.
18	29.457	64.8	64.0	52.3	63.4	53.0	58.2	Ditto.		W.
19	29.517	64.5	63.0	52.8	62.0	61.0	61.5	Ditto.		W.
20	29.537	64.0	64.3	51.2	63.0	52.0	57.5	Ditto.		W.
21	29.533	63.7	64.0	51.5	62.3	52.0	57.15	Ditto.		W.
22	29.459	64.0	63.0	52.4	64.0	52.5	58.25	Ditto.		W.
23	29.443	63.9	64.0	51.0	64.0	52.0	58.0	Ditto.		W.
24	29.409	64.5	63.9	55.0	64.0	51.5	57.75	Ditto.		W.
25	29.496	63.4	62.8	53.0	64.4	53.7	59.05	∼ scattered.		W.
26	29.482	63.2	63.2	52.2	63.5	52.0	57.75	Clear.		N.
27	29.496	62.5	61.4	52.5	64.4	51.3	57.85	Ditto.		W.
28	29.422	62.5	61.9	52.0	61.2	51.0	56.1	⌣ a few scattered.		S.
29	29.450	63.0	62.0	52.7	61.0	52.5	56.75	∼ all over.		W.
30	29.450	63.2	62.2	52.8	62.1	54.0	58.05	\ a few scattered.		N.
31	29.436	63.0	62.5	55.5	62.0	60.0	61.0	⌣ all over.		E.
	29.471	65.33	64.79	54.46	64.45	53.85	59.15		0.42	

Meteorological Register kept at the Office of the Secretary to Government N. W. P. Agra, for the Month of January 1853.

Maximum pressure observed at 9.50 A. M.

Date.	Barometer.	Temperature.			Maximum and Minimum.			Aspect of the sky.
		Of Mercury.	Of Air.	Wet Bulb.	Maximum.	Minimum.	Direction of the Wind.	
1	29.457	61.2	61.0	55.1	..	..	N.	⌒ all over.
2	29.572	53.2	53.0	50.5	..	..	N.	Ditto.
3	29.634	55.5	55.9	49.5	..	..	W.	Clear.
4	29.608	55.9	57.0	48.5	..	..	W.	Ditto.
5	29 632	56.0	56.5	48.8	..	..	N.	⌒ a few to N.
6	29 613	59 0	58.0	50.5	..	..	E.	Ditto.
7	29.529	60.0	59.0	52.3	..	..	E.	⌒ ½ scattered.
8	29.526	59.5	61.5	51.8	..	..	N.	\ a few scattered.
9	29.510	59.8	59.0	53.6	..	..	N.	⌒ all over.
10	29.413	60 5	60.3	55.3	..	..	N.	Ditto.
11	29.570	60.0	56.7	52.7	..	..	W.	Ditto.
12	29.564	55.5	55.3	48.6	..	..	W.	⌒ a few scattered.
13	29.559	59.0	58.5	52.5	..	..	N.	Ditto.
14	29.616	56.0	56.5	50.6	..	..	W.	Clear.
15	29.536	56.4	56.5	48.6	..	..	W.	Ditto.
16	29.541	57.6	57.5	50.0	..	..	W.	⌒ all over.
17	29.683	52.0	52.0	49.5	..	..	N.	Ditto.
18	29.689	54.0	54.5	51.0	..	..	W.	Clear.
19	29.597	55.0	55.1	49.6	..	..	Ld.	⌒ ½ scattered.
20	29.561	58.4	57.8	52.5	..	..	E.	⌒ scattered all over.
21	29.425	59.0	58.4	53.5	..	..	E.	⌒ a few scattered.
22	29.536	56.1	56.1	51.0	..	..	N.	Clear.
23	29.493	58.8	58.7	51.5	..	..	N.	\ a few towards S.
24	29.432	59.5	59.0	52.5	..	..	S.E.	Clear.
25	29.479	59.0	59 0	51.5	..	..	E.	Hazy all over.
26	29.414	60.0	59.3	54.4	..	..	E.	⌒ all over.
27	29.530	56.5	55.0	52.1	..	..	N.	Ditto.
28	29.681	53.6	54.5	53.0	..	..	S.	⌒ a few scattered.
29	29.673	58.0	57.2	51.5	..	..	N W.	Clear.
30	29.641	58.5	56.7	49.0	..	..	W.	Ditto.
31	29.538	59.5	59.5	49.2	..	..	W.	Ditto.
Mean.	29.557	57.5	57.3	51.3	..	..	..	

Meteorological Register kept at the Office of the Secretary to Government N. W. P. Agra, for the Month of Jan. 1853. LATITUDE.

Observations at apparent Noon.

Date.	Barometer.	Temperature.			Maximum and Minimum.			Aspect of the sky.
		Of Mercury.	Of Air.	Wet Bulb.	Maximum.	Minimum.	Direction of the Wind.	
1	29.419	62.0	61.3	56.4	..	..	N.	∩ scattered all over.
2	29 524	55.8	56.0	52.0	..	..	N.	Clear.
3	29.569	59.0	59.0	51.3	..	..	N.	∩ a few scattered.
4	29.542	60.0	60.5	50.0	..	..	N.	Clear.
5	29.534	59.5	59.1	50.5	..	..	S E.	∩ scattered.
6	29.571	60.7	59.4	51.1	..	..	N.	∩ in zenith.
7	29.481	61.0	60.1	52.0	..	..	E.	∩ scattered.
8	29.491	61.2	60.9	52.7	..	..	W.	\ a few scattered.
9	29.451	61.0	60.4	54.8	..	..	N.	∩ all over.
10	29.377	60.1	60.5	55.5	..	..	N.	∩ scattered all over.
11	29.546	60.0	59.6	54.0	..	..	N.	∩ in zenith.
12	29.505	58.0	57.5	49.8	..	..	S.	\ a few scattered.
13	29.535	61.0	60.0	63.0	..	..	N.	\ ⅓ scattered.
14	29.578	60.0	59.6	50.8	..	..	W.	Clear.
15	29.497	59.3	58.4	50.0	..	..	W.	Ditto.
16	29.520	59.5	58.5	51.5	..	..	W.	∩ all over.
17	29.626	56.0	56.0	51.5	..	..	N.	∩ a very few scattered.
18	29.653	57.6	57.5	51.0	..	..	N.	Clear.
19	29.530	57.0	56.2	50.0	..	..	N.	∩ all over.
20	29.483	59.0	57.4	52.1	..	..	E.	∩ in zenith. ∩ towards N.
21	29.364	60.0	59.8	54.5	..	..	S.	∩ in zenith.
22	29.481	59.0	59.3	53.5	..	..	N.	Clear.
23	29.446	60.0	59.2	53.2	..	..	N W.	\ a few towards S.
24	29 367	60.5	59.3	52.5	..	..	S.W	\ a few in zenith.
25	29.437	61.0	59.7	52.2	..	..	W.	∩ in zenith and hazy towards horizon.
26	29.353	60.5	59.3	53.2	..	..	E.	∩ all over.
27	29.501	58.0	57.5	53.5	..	..	N.	∩ ½ scattered.
28	29.615	58.0	57.8	53.9	..	..	N.	∩ a few scattered.
29	29.605	59.0	57.6	51.0	..	..	N.W.	Clear.
30	29.589	60.9	60.6	49.9	..	..	N.W.	Ditto.
31	29.445	64.2	64.0	51.5	..	..	W.	Ditto.
	29.504	59.6	59.1	52.5	..	..	..	

Meteorological Register kept at the Office of the Secretary to Government N. W. P. Agra, for the Month of Jan. 1853. LONGITUDE.

Minimum pressure observed at 4 P. M.

Date.	Barometer.	Temperature.			Maximum and Minimum.			Aspect of the sky.	Rain Gauges.	
		Of Mercury.	Of Air.	Wet Bulb.	Maximum.	Minimum.	Mean.		3 feet 2 inches from the ground.	Direction of the Wind.
1	29.367	63.5	63.8	57.5	61.1	54.9	58.0	∩ a few to S.		W.
2	29.497	60.5	59.8	55 3	60 2	49.8	55.0	∩ ¼ scattered.		N.
3	29.531	61.0	60.5	52.0	59.2	49.6	54.4	Clear.		N.
4	29.480	62.8	62.5	51.1	59.7	50.0	54.85	Ditto.		N.
5	29.497	61.0	60.9	51.5	60.2	49.9	55.05	\ a few scattered.		Ld.
6	29.485	62.0	61.0	52.1	60.4	55.0	57.7	_ scattered.		N
7	29.423	62.0	61.7	52.5	61 0	56.0	58.5	∽ all over.		E.
8	29.420	63.0	62.1	53.5	62.5	54.5	58.5	∩ in zenith and ∽ towards hor.		E.
9	29.401	62.0	61.5	55.8	61.0	56.0	58.5	∽ all over.		N.
10	29 362	63.0	62.1	57.0	62.0	56.0	59.0	∩ scattered over.		N.
11	29.489	62.0	61.3	53.6	60 6	53.0	56.8	_ scattered.		N.
12	29.427	60.5	59.5	50.0	59.0	50.0	54.5	_ a few scattered.		Ld.
13	29 451	61.5	61.1	53.8	60.5	56.0	58.25	_ very few.		N.
14	29 500	62.5	61.1	51.5	60.4	53.8	57.1	Clear.		N.
15	29.421	62.2	60.8	50.0	60.8	51 3	56.05	\ a few scattered.		N.
16	29 475	57.9	57.9	52.5	57.0	57.2	57.1	∽ all over.		N.
17	29.575	58.5	57.5	52.4	57.0	50.0	53.5	A very few ∩ scattered.	1.4	N.
18	29.564	59.5	59.0	51.8	58.0	50.0	54.0	Clear.		N.
19	29.485	58.5	57.2	50.2	57.0	51.3	54.15	∽ all over.		N.
20	29.410	59.9	59.4	52.0	59.4	51.6	55.5	∩ in zenith ∽ towards N.		E.
21	29.302	63.0	63.0	56.6	62.0	56.5	59.25	∩ a few scattered.		W.
22	29.430	62.0	61.4	53.0	60.5	53.0	56.75	Clear.		N.
23	29.352	61.5	61.0	52.5	61.0	56.5	58.75	_ a few scattered.		W.
24	29.321	62.0	61.3	52.0	60.5	55.9	58.2	_ scattered all over.		E.
25	29.369	61.3	60.5	52.2	59.3	56.5	57.9	∽ to E. W. & N. ∩ to S.		E.
26	29.342	60.0	59.0	54.5	59.0	59.0	59.0	Raining. ∽ all over.		E,
27	29.469	60.5	59.1	54.6	59 0	54.6	56.8	∩ a few scattered.	1.0	N.
28	29.574	60.	59.6	54.2	59.0	50.5	54 75	Ditto.		N.
29	29.570	60.0	60.9	51.4	59 8	56 5	58.15	Clear.		N
30	29.527	64.0	64.0	52.0	63.0	56 2	59.6	Ditto.		N.
31	29.383	68.3	68.0	54.2	66.3	53.4	59.85	Ditto.		W.
	29.448	61.5	60.9	53.3	60.2	53.7	56.95		2.4	